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CONTENTS

PAGE

ORIGINAL ARTICLES—

I. The Immediate Effect of Artificial Self-fertilization on some Economic Characters of the Cotton Plants—*By C. Jagannatha Rao, B.A.* 113

II. A Prospect for the Poromboke or the Cultivation of the Cashewnut—*By L. Krishnan, B.A.* 120

III. The Cultivation of Amaranthus at Rega—*By G. Rogi Raju, Dip. Agri.* 123

IV. The Economics of Paddy Growing in Tanjore—*By K. Ramiah, M.Sc. (Cantab.) L.Ag.* 124

LIVESTOCK, PLOUGHS AND CARTS—CENSUS OF 1930—A REVIEW. 129

SELECTED ARTICLES—

India's Commercial Fibres 133

NOTES AND COMMENTS 136

GLEANINGS 138

REVIEWS 140

CORRESPONDENCE 143

FARMING CALENDAR FOR THE COIMBATORE DISTRICT—APRIL ... 145

COLLEGE NEWS AND NOTES 146

WEATHER REVIEW 148

AN APPEAL FOR THE CECIL WOOD MEMORIAL 150

DEPARTMENTAL NOTIFICATIONS 152

APPENDIX—Additions to the Library 153

ERRATA

1. February number, page 73, line 26, *for* ' Rs. 20 ', *read* ' Rs. 90 '.
2. February number, page 73, line 26, *for* ' finding ', *read* ' guiding '.

> Farming will never be a success unless the farmer had more voice in the disposal of his produce.—P. Morrel.

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Vol. XIX] MARCH 1931 [No. 3

THE IMMEDIATE EFFECT OF ARTIFICIAL SELF-FERTILIZATION ON SOME ECONOMIC CHARACTERS OF THE COTTON PLANT

By C. JAGANNATHA RAO, B.A.

Assistant to the Cotton Specialist, Nandyal.

Introduction.—The cotton flower being large and showy, attracts many insects and this results in a certain amount of cross-fertilization. Experimental evidence has been overwhelming to prove that vicinism ranging from nearly 2 to 100 per cent occurs in the various cottons investigated, the amounts being determined by the peculiar environmental conditions in each case (2).

In breeding work with cotton, in order to avoid cross-pollination, protection of flowers by artificial means becomes inevitable. Again, to evaluate the purity in the economic characters, the breeder is often forced to examine both the selfed and the naturally pollinated material. It is, therefore, in the fitness of things to know whether selfing affects the characters under study and if so in what direction. No apology is, therefore, needed to devote this paper to a study of the immediate effect of artificial self-fertilization as compared with the natural process.

Material.—The data for the present study were obtained from pure cultures grown during the two seasons—1927–28 and 1929–30—the first at the Agricultural Research Station, Koilpatti, Tinnevelly District, and the second at the Agricultural Research Station, Nandyal, Kurnool District. The cultures which furnished the material were No. 538, a pure strain of *Karunganni* (*G. indicum*) and No. 54, a pure strain from 'Northern' (*G. indicum*). During both the seasons, plants were raised from seeds derived from self-fertilized flowers.

SEASON

1927–28. At Kovilpatti.—The annual rainfall recorded for the year was 36·4 inches, i.e. about 5 inches over and above the average for the preceding 23 years. The monsoon or sowing rains broke at the usual time and the sowings of cotton were at normal period (end of October) and germination good. Unwanted rains to the total extent of 4 inches were received in February 1928.

1929–30. At Nandyal.—The total rainfall for the year was a little over 20 inches as against the rounded average of 30 inches for the preceding 23 years. Despite this exceptionally low rainfall for the year, its distribution must be declared to have been good, barring inadequate sowing rains. The result was a record cotton crop, the final yields far surpassing the initial expectations. The normal sowing time in this tract is towards the end of August and the year under review was no exception to this.

Method of selfing.—The process of selfing was done by the sewing method as described by Parnell and Hilson (10). It consists in sewing up the tip of the unopened flower bud on the evening immediately preceding the day or in the morning itself of the day of the opening of the flower bud and at the same time passing the piece of thread to the persistent bracts. This process renders the identification of the resulting 'selfed' boll at the time of its gathering. This is the usual method of self-fertilization adopted at the Agricultural Research Stations of the Madras Agricultural Department in all breeding work with cotton.

PLAN OF WORK

1927–28. (Culture 538).—Plants in a few rows of the plot of Culture 538 were earmarked for the experiment and numbered serially. Every morning, half the number of flower buds that are to open that day were sewn up, the remaining half being left for natural pollination to serve as controls for comparison. The selfing operation was begun from the 15th of February 1928 to the end of March and in all, 1,609 flowers were 'selfed' and 1,535 flowers were left for natural pollination. The flowers of each day, both selfed and non-selfed, were tagged with dated labels to indicate their flowering dates and also the serial numbers of the mother plants. As the bolls matured and burst, the selfed and the control non-selfed bolls were gathered separately every day with their capsules and dated tags, and kept duly labelled with their respective picking dates for examination in the laboratory. All the four-locked bolls were then sorted into three-day groups according to the flowering dates. Healthy selfed and naturally fertilized bolls were then picked in each group and the locks in each were separately examined for ovules and seeds and the respective averages calculated. Then, from each class, five representative seeds of third position as described in (1) *Agricultural Journal of India*, Vol. xxv, Part 1, were separated out for the determinations of staple length, the method followed being the usual one adopted by Hilson (4). From the remaining seeds of each lot, one-hundred representative seeds or as many as possible if less than hundred, were taken out for the determination of lint and seed weights. The samples were ginned and the weights of seeds and lint determined.

1929–30 (Culture 54 at Nandyal).—Two adjacent rows in the seed multiplication plot of Culture 54 were marked out and one hundred and fifty plants in one row were tagged for selfing the flowers that opened daily. An equal number in the adjacent row were labelled as control plants. This procedure was adopted with a view to obtain a larger amount of material for examination than could have been procured if it had been attempted to eliminate plant to plant variation as was done during 1927–28. Flowering records were maintained for the selfed and non-selfed lines. The rest of the procedure adopted was the same as in 1927–28 at Kovilpatti except that the blooms were not tagged daily with flowering dates and that the three-day grouping was on picking date basis. On each picking day, at intervals of three days, the selfed and the non-selfed bolls were separately gathered *en bloc*. For the determination of lint length, six seeds of the third position were combed instead of five as in 1927–28.

Selfing was commenced from November 16, 1929, and continued up to February 15, 1930 and in all 2,957 flowers were stitched up for self-fertilization. In this Culture 54, the predominating kind of boll was three-locked and hence bolls of this category alone were taken for the study of characters.

RESULTS

Flowering and Bolling curves (1929–30).—Plate I shows the flowering and bolling data of the selfed and the non-selfed lots worked to per plant per day and transformed into illustrative curves. The curves for the selfed and the non-selfed lots are practically identical and are suggestive of no material differences. Kearney (5) also finds no difference in the rate of flowering between selfed and non-selfed plants.

Characters of boll contents 1927–28 and 1929–30.—The characters studied are :—

1. Ovules per lock,
2. Seeds per lock,
3. Fertility index,
4. Lint length,
5. Kapas weight per seed,
6. Lint weight per seed,
7. Seed weight per seed, and
8. Ginning percentage.

In all these cases, readings of the same flowering date groups for results of 1927–28 and of the same picking date groups for results of 1929–30 were compared and their differences were tested statistically as per Student's method. The results are summarized in the table.

OVULES AND SEEDS PER LOCK AND FERTILITY INDEX

The table gives the averages and the differences for these characters. The term fertility index has been used to signify the percentage of ovules

developing into seeds. This index has been very high at Nandyal in the case of 54 cotton and this may be due to the peculiar conditions experienced during the year which resulted in bumper yields. Knowlton and Sevy (8) are of opinion that abnormally high temperatures at bloom (75° to 85°) may reduce the set by its permanently injurious effect on pollen tubes and pollen tube-growth. Among others, this may be one of the possible causal factors for a lower index at Kovilpatti. However, to say that it has been due to environmental conditions in the generality of years, evidence is lacking. In any case, it cannot be said to be a trait peculiar to strain 54, for, most other cottons during the same year exhibited remarkable fecundity. It seems to be a line worth pursuit as high fecundity conduces to yarn uniformity. In all these characters studied the differences found are seen to be statistically insignificant. The results shown in the present paper are not in agreement with the observations of Darwin and Kearney. Darwin (3) concluded that self-fertilization assures the production of a large supply of seeds in the case of many crops. Kearney and Porter (7) in 1927 published that 'bagged flowers produce fewer seeds per boll doubtless, because pollen reaches that part of the stigmas in contact with or immediately above the uppermost anthers.' Earlier still, Kearney (6) reported 'that the better pollination under natural conditions at Sacaton resulted in a higher average number of seeds per lock.' Short stigmas in our indigenous cottons possibly account for the existence of no difference in fertility between the selfed and the non-selfed flowers.

Lint length.—The two places which formed the centres of the experiment are so diverse in their soil and atmospheric conditions that in regard to lint length at Kovilpatti, the figures show a rise and a fall whereas at Nandyal a systematic drop in lint length is noticed with the advance of the season. Whether this phenomenon is found to hold good as a general rule with the other cottons also is yet to be seen. During both the years, even among the diversity there is uniformity in that the selfed and the non-selfed bolls do not exhibit any significant differences.

Kapas, lint and seed weights per seed and ginning percentage.—A study of the table and plate II brings out the averages, the errors and the general shapes of the curves. The curves further show that with 54 at Nandyal the weights per seed of kapas, lint and seed sustain more systematic falls with the advance of the season than 538 at Kovilpatti. Further, both at Kovilpatti and at Nandyal, the rate of fall in seed weight is more rapid than that in lint weight during the fag end of the season with the result that the ginning percentage at this period is not pulled down to the extent to which it would have fallen had the two rates of fall mentioned above been in the same proportion. The differences noted in these characters also are found to be statistically very insignificant.

LITERATURE AND CONCLUSION

Kearney (5) found 'that inbreeding Pima Egyptian cotton by controlled self-fertilization for seven generations brought about no reduction in the rate of flowering, in percentage of bolls retained, in the size, weight and seed content of the bolls or in the abundance of the fibre'. Compared with continually open-pollinated stock, Kearney found that inbreeding has no harmful effect on the improved strains of Pima cotton with which he worked. Brown (2) concludes 'in inbreeding work with Express cotton

carried on for three generations, there was no apparent loss in fertility of flowers but the strains appeared to decrease in vigour as compared with open pollinated strains. The weight of plants, rate of flower production, number of bolls produced and weight of seed cotton were taken as an index of vigour'. Kotowiski (9) working on cabbage observes 'that favourable cultural conditions are believed to tend to smooth down the differences between selfed and open-pollinated seedlings'.

Focussing attention on the two cottons 538 (of Koilpatti) and 54 (of Nandyal), both are strains evolved after the inevitable process of continued self-fertilization. Strain 54 has been continually self-fertilized for over eight years and No. 538 for a comparatively lesser number of years. It must be noted that it is only in the years of the present experiment that the control flowers have been naturally fertilized—the ancestors, both in the year immediately preceding and in the years further removed being continually selfed. A glance at the table will reveal that even among the slight differences in characters between the selfed and the non-selfed lots, No. 538 during 1927–28 has been exhibiting greater differences and errors systematically in most of the characters than No. 54 cotton in 1929–30.

A mathematical consideration of all the characters and the differences between the selfed and the non-selfed flowers summarized in the table must drive us to the conclusion that there is no immediate effect, either harmful or beneficial, as a result of artificial self-fertilization. In all the characters studied, the differences are found to be statistically very insignificant. In breeding work with cotton, the breeder has often to depend upon the results obtained from a study of the natural-fertilized plants in addition to the self-fertilized ones. Owing to the impracticability of selfing the whole material from considerations of time and labour, it is a good sign that the immediate effect of artificial self-fertilization in cotton in a state of genetic purity is nothing different compared to that of open-pollination. Hence, the material obtained from the selfed and the non-selfed plants can be used without any hesitation for the study of characters.

Acknowledgment.—The writer is indebted to M. R. Ry. V. Ramanatha Ayyar Avl., Cotton Specialist, Agricultural Research Institute, Coimbatore, for his very valuable suggestions.

SUMMARY

The above study demonstrates that:—

1. No appreciable differences are observed in the flowering and the bolling curves obtained from plants, the flowers of which are partly selfed and partly left for natural pollination.

2. The eight boll characters studied namely (*a*) ovules per lock, (*b*) seeds per lock, (*c*) fertility index, (*d*) lint length, (*e*) kapas weight per seed, (*f*) lint weight per seed, (*g*) weight per seed and (*h*) ginning percentage are not affected by the process of selfing the flowers, and this is a very healthy sign from the point of view of cotton breeding as naturally-fertilized material can also be used for the study of characters.

Table showing the differences in the economic characters of selfed and non-selfed bolls

KOVILPATTI 1927-28 No. 538 — NANDYAL 1929-30 No. 54

Character	Strain No.	Year	No. of locks	No. of Sets	Average of selfed bolls	Average of naturally pollinated bolls	Difference	σ difference	Difference σ ÷ difference Z	P	Odds	Significant or not
Ovules per lock ...	538	1927–28	4	15	5·85	5·77	·08	·33	·24	·80	4 : 1	no
	54	1929–30	3	22	6·50	6·42	·08	·26	·31	·91	11:1	no
Seeds per lock ...	538	1927–28	4	15	4·06	4·19	·13	·71	·19	·75	3 : 1	no
	54	1929–30	3	22	6·21	6·15	·06	·33	·18	·79	4 : 1	no
Fertility per cent.	538	1927–28	4	15	69·60	72·87	3·27	11·05	·30	·86	6 : 1	no
	54	1929–30	3	22	95·45	95·63	·18	·87	·21	·83	5 : 1	no
Lint length ...	538	1927–28	4	14	23·57	23·29	·28	1·03	·28	·83	5 : 1	no
	54	1929–30	3	21	25·19	25·09	·10	·61	·16	·75	3 : 1	no
Kapas weight per seed.	538	1927–28	4	10	87·90	85·70	2·20	5·21	·42	·88	7 : 1	no
	54	1929–30	3	21	70·33	70·71	·38	3·01	·13	·71	2·5 : 1	no
Lint weight per seed.	538	1927–28	4	10	26·90	25·80	1·10	2·26	·49	·91	10 : 1	no
	54	1929–30	3	21	21·71	22·09	·38	1·21	·31	·91	10 : 1	no
Seed weight per seed.	538	1927–28	4	10	61·00	59·90	1·10	5·00	·22	·74	3 : 1	no
	54	1929–30	3	21	48·62	48·62	nil	2·23	nil	nil	nil	no
Ginning per cent.	538	1927–28	4	10	30·60	30·20	·40	2·94	·14	·66	2 : 1	no
	54	1929–30	3	21	30·81	31·19	·38	1·13	·34	·92	12 : 1	no

Remarks :—In No. 538, 4-locked bolls predominate and in 54, 3-locked ones.

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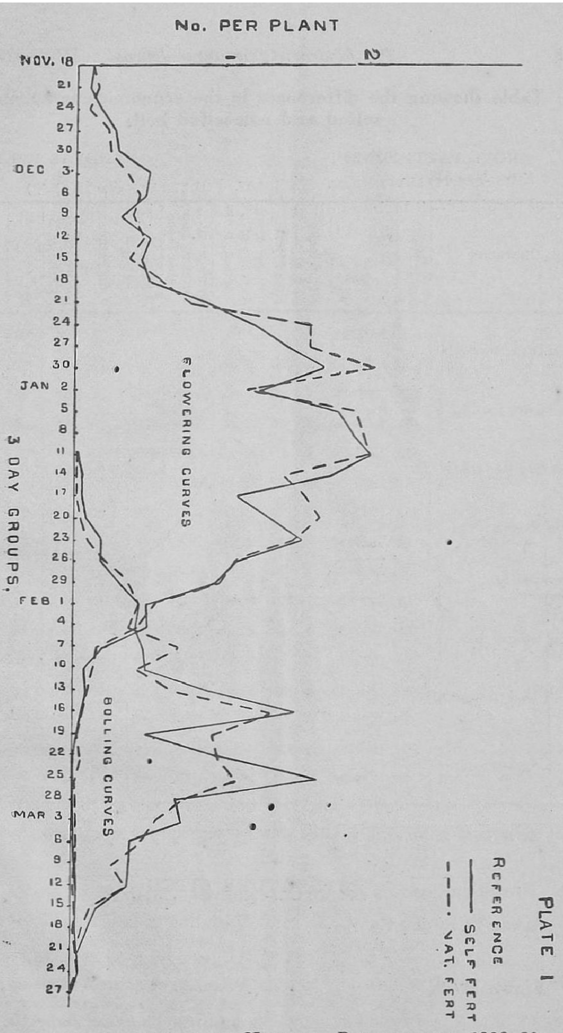
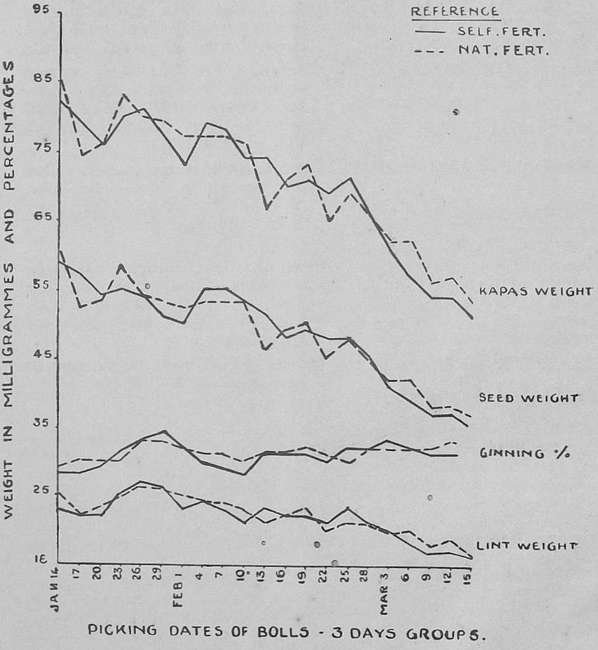


SELF-FERTILISATION *vs.* NATURAL POLLINATION, 1929–30
Nandyal Strain 54 Flowering and Bolling Curves.

SELF-FERTILISATION *vs.* NATURAL POLLINATION, 1929–30

Nandyal Strain 54—3-locked bolls Kapas, Lint and seed weights per seed and Ginning per cent.



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A PROSPECT FOR THE POROMBOKE OR THE CULTIVATION OF THE CASHEWNUT

By L. KRISHNAN, B.A.

Student B.Sc. iii

Waste lands in many parts of the country can be turned into productive areas by being put to the permanent cultivation of useful trees like the cashewnut. The cashewnut (botanically *Anacardium occidentale*), thrives well in such lands on account of its hardy nature. The tree claims its heritage originally from South America, and is now well established in the coastal forests of India. It grows in a wild state and can be grown in almost all soils, although gravelly and sandy loams suit it best.

The cashewnut of commerce (Tamil—*Munthirikottai*) is really the fruit of this tree. The flower stalk on which the 'nut' rests, is succulent and edible, and is known as cashew apple, and is mistaken by the layman for the fruit.

The tree in its wild state has a spreading habit usually growing to a height of 10 to 15 feet, and rarely to 25 feet, although under cultivation it is said to have attained a height of 40 feet. When well cared for, this is a valuable and promising tree, responding well to irrigation and manuring, though it can also thrive under very adverse conditions. In the Travancore State, it is cultivated in a systematic manner, and the finished product is exported to foreign markets. Around Tanjore and in the Pudukottah State the tree grows wild, and the produce which is collected by the women folk, is either consumed locally or sent to other places through the middlemen of the Tanjore market.

The usual method of cultivation is as follows :—

The land is ploughed thrice, and the seed dibbled behind the country plough in rows 15 feet apart, the same distance being maintained between two seeds. The tree can also be propagated vegetatively but is commonly raised from seeds. Seeds are sown during the break in the monsoon, in the months of September or October. The seedlings are not usually watered, but for the first six months have to be protected against the depredations of wild animals, which dig them up for their edible roots. The trees begin to bear from the fourth year onwards in good, and the sixth year onwards in poor soil. The tree is in flower in the months of December, January and February, and the fruits are ready in April-May. The produce is usually collected by women who are paid in kind, the perishable cashew apple being given as wages. The owner of the garden engages a watch during the harvesting season.

All allowances made, there will be about 200 trees to an acre, and the yield ranges from 250 to 300 Madras measures of dried nuts per acre. The price fluctuates considerably from 4 to 8 Madras measures per rupee. With the prevailing primitive system of cultivation, the ryot gets on an average a net return of about Rs. 40 per acre. The tree yields for 15 years and by the 20th year the flowering completely ceases. It is said that the tree lasts for 25 years, but it is never economical to keep it after the 20th year. The maximum yields are obtained after the 8th year.

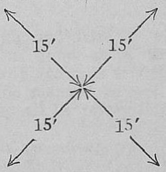
Uses.—It is reported that the following bye-products are also obtained from the tree;—*from the stem*—the bark of the tree yields a reddish yellow gum which is slightly soluble in water. The bark is used for tanning. The sap issuing out of the incision on the stem, is used as an indelible marking ink and the native workman uses this also for soldering metals. The stem yields a reddish hard timber which is used in Burma for packing cases, boat building and for the manufacture of charcoal; *from the fruit*—the cashew apple is eaten as a remedy for scurvy. It can be preserved as a jam and can even be sent outside, if a demand is created. By fermenting the juice a wine is prepared, by distilling which a spirit is obtained. This also has got the antiscorbutic properties; *from the nuts*—two distinct oils are manufactured from the nuts. (i) Kernel oil— this is reported to be very nutritious and even superior to almond oil. The yield is about 40 per cent, but since kernels are eaten in India the manufacture of this oil will be very limited. (ii) Pericarp oil—manufactured from the pericarps of the nuts, is black, acrid and powerfully vessicating. The Andamanese are using this for preserving their fishing line; it can be used to preserve carved woodwork, and books, against white ants and other insects, and is also employed as an anæsthetic in leprosy. The shell oil crudely prepared by maceration with spirit, is sometimes applied for cracks in feet.

The kernels are made into confectionery with sugar, and are inevitable constituents of Indian preparations during festivities.

The following improvements in the method of cultivation are suggested:—

(i) *Nursery.*—Instead of dibbling the seeds in the plantations direct, a small nursery is raised and seedlings are transplanted after four months. The advantages of the nursery are obvious. The nursery is well prepared and can be watered regularly; it gives the seedling a good start, and being compact can easily be protected against wild animals. In the older method a number of gaps in the plantations is inevitable, but by raising a nursery this difficulty is got over. Two Madras measures of seed are required for an acre.

(ii) *Planting.*—While the seedlings are in the nursery the main field can be leisurely prepared. Pits are dug at the corners of an equilateral triangle of 15 feet side as shown below:—300 plants to an acre can easily be planted in this manner whereas the ryots' method will accommodate only 200. The seedlings are transplanted a month before the monsoon rains and watered once. Any failures after the rains are immediately replaced. Subsequent irrigation and manuring are not necessary, but the plants do respond to the application of manure and to an occasional watering.



(iii) *Inter-cultivation.*—This is occasionally done to remove weeds, to conserve moisture, and as a sort of root pruning. For the first four years, a few crops of pulses like red gram, can be raised without doing harm to the growing trees.

(iv) *Pruning*.—The tree can be forced to grow erect by judicious pruning and the timber—which is thus made more valuable—can be utilized for purposes like boat-building.

Details of cost of cultivation :—

The *present* method.	Rs.	A.	P.	The *improved* method.	Rs.	A.	P.
3 ploughings ...	4	8	0	Preliminary ploughing.	4	8	0
2 M. M. of seed...	0	6	0	Pitting, manuring and planting ...	20	0	0
1 ploughing for covering seed ...	1	8	0	Cost of 300 plants raised in nurseries ...	10	0	0
[1]Watch and watering first year ...	10	0	0	[2]Watch and watering first year ...	6	0	0
	16	6	0		40	8	0

The initial cost under the improved method is certainly greater, but is amply compensated by the increased outturn. Under the primitive method the net return is only Rs. 40 per acre, whereas a net gain of Rs. 60 per acre every year is a modest estimate in the plantations raised by the improved method.

Preparing the produce for the market and the marketing.—A small industry can be started in places where the tree is grown, on the pattern of the one at Travancore. The Quilon factory is said to export on an average 600,000 lbs. of cashewnut a year. The produce can be collected and marketed on a co-operative basis, eliminating the middlemen, who now take an undue share of the profits of the ryots' labour.

[1] Watch for 6 months. [2] Watch for 2 months.

THE CULTIVATION OF AMARANTHUS AT REGA

By G. JOGI RAJU, Dip. Agri.

District Agricultural Officer

In the Vizianagaram market, what is known as 'Rega thotakura' (a kind of amaranthus) is a speciality. It comes down from Rega, a small village adjoining the town. The variety cultivated is known as 'Pedda thotakura' and is grown for its stalk which is allowed to mature. This variety is distinct from 'Mokka thotakura' of which the whole plant is used as a green when comparatively tender. The special merit of 'Rega thotakura' is that while the outer layer of the stem is hard, the inner portion is soft, non-fibrous and sweet when cooked, these qualities not being developed to anything like the same extent in the amaranthus grown elsewhere. Even at Rega, the above qualities are said to develop best on only high lying dark red loams, the plants grown on other soils being said to be inferior. The poorer the soil the better is the quality. Sheep penning combined with the application of 'penta' which consists mostly of ashes is also said to give the best quality.

2. The seed is sown in a nursery in the latter half of May, in beds about 4 to 6 feet square, and transplanted in about 2 to 3 weeks. The seedbed is heavily manured with 'penta'. $\frac{1}{2}$ to $\frac{3}{4}$ seer of seed is sown in about 200 to 300 square yards of nursery to plant an acre. The land to be planted is thoroughly ploughed for about two months previously, manured with about 50 to 100 cartloads of 'penta' per acre, and further penned with sheep at about a thousand per acre. Tannery refuse is sometimes applied but this is said to invariably result in the poor quality of the produce. The seedlings are planted about $1\frac{1}{2}$ to 2 feet apart and are allowed to grow for about 3 to 4 months by which time they get fit for sale. During this period the soil is kept free from weeds by occasional hoeing and weeding.

3. The crop is sold wholesale to vendors at about Rs. 100 to Rs. 200 per acre, while the retail price in the Vizianagaram market is about 3 pies per plant. A few plants are left to mature seed for the following season. The seed is sold at about a rupee per seer.

4. Many people who took the seed from Rega and tried it elsewhere, state that the quality of stems was never so good as of those grown at Rega. What the special quality of the crop grown at this place is due to, is a matter for investigation. The soil, the manure, as well as the transplanting which is not done elsewhere, may all be responsible.

'THE ECONOMICS OF PADDY GROWING IN TANJORE' [1]

By K. RAMIAH, M.Sc. (Cantab.), L.Ag.

Paddy Specialist

The work of improvement of any particular crop consists of four distinct stages, (1) cultural improvement, i.e. better cultivation of the land, better manuring, use of proper seed rate; etc., (2) growing of particular varieties most suitable to the locality, (3) improvement in such varieties by isolation of superior strains, and (4) producing better varieties by hybridization. The first two lines of work are being tackled by the department for over two decades now and the results are quite familiar to you all. Lines 3 and 4 are definitely more the work of a Crop Botanist and work on these for this province was commenced just 16 years ago. This station is the outcome of the Crop Botanist's work and has been in existence for the last nine years. While some of you here would realise that something has been done by this section of the department to benefit this district, I am sure there are others who feel that more has not been done. That the public is impatient and expects results more rapidly is a healthy sign. As one however who has had a very intimate knowledge of crop improvement work in some of the most advanced agricultural countries of Europe, I do not at all feel diffident of the results achieved so far. It must be mentioned, at the same time, that most of the improvements in these European countries were being done in the earlier years by enterprising farmers themselves. Every other farmer there was a Sabapathi Mudaliar of Bellary, and a Raghunatha Rao of Tanjore. In Sweden, there is a private association which is running a Plant Breeding Institute quite as big as the Agricultural College at Coimbatore, with a set of highly paid technical staff all of whom have earned world wide reputation by their scientific achievements. In Denmark, all the work which the Government Crop Specialists of this country are engaged in, is being done by private seedsmen in their private farms and specially equipped field laboratories. In all these countries, there has been a general all round improvement and the standard brought up to such a high pitch that an increase of even 2 to 3 per cent over their present output would be considered a very big advance. In India, the general standard is still low and so far as the Crop Specialist's work goes, there is immense scope for improving the present output by about 10 per cent by mere isolation of superior strains from the existing varieties of crops. In fact this is what is being done in Madras and all the paddy strains that have so far been issued are merely isolated strains. To breed new varieties by hybridization requires a complete knowledge of the plant and its make-up and the way in which the different characters of the plant are carried forward from parent to progeny. A good deal of knowledge has been gained in this line regarding the rice plant during the last fifteen years in Madras. It is only a question of time before we will be able to place at the disposal of the farmers superior varieties as a result of hybridization work.

[1] Extracts from address to the Mirasdars' Conference, Aduturai, January 1931.

Let us now consider the general position regarding the growing of paddy. Every country is racing as it were to increase its output of food grains. This should result in over-production and a consequent fall in prices. When we compare the average acre yields of some of the important rice growing countries of the world we are terribly backward. Spain, Italy and Japan beat us hollow. Though our yields are low, our cost of production per unit of paddy is definitely less than elsewhere due chiefly to our comparatively lower cost of labour. I am sure some of the mirasdars are getting alarmed even now at the present rise in the wages of the labourer of this district. His standard of living is still considerably low although it is gradually but surely rising. In all the rice growing countries the tendency is to extend the area and to try to improve the yield per acre. Even in this Presidency there are several factors tending towards over-production. Besides the activities of the department which tend to increase the acre yields, there are the contemplated big irrigation schemes which have been designed to bring large areas under paddy cultivation. Assuming that about 50 per cent of the population of this province are rice eaters, our production would just meet the requirements of the province. Still there is a big consignment of rice which is imported into the province every year from Burma, and recently from Indo-China too. I am not sure whether this would balance the probable export of rice from this province to the neighbouring provinces and to a small extent outside India as well, for example, to Ceylon. The present abnormally low prices of paddy cannot be said to be due entirely to over-production. It might be one of the contributory causes. This abnormal condition probably has affected some of the industrial crops like cotton and groundnut much more than in the case of paddy.

In the race for the increase of rice production, countries which have better natural facilities should score over those which have not got them. Even in India, Madras, though it has a greater acre-yield than other provinces, has the least chance to compete successfully in getting a market for its produce as compared to provinces like Burma, Bengal, Assam, etc. In Madras, 70 per cent of the paddy grown is irrigated, that is, has to meet a charge for water, either in the form of water rate or as cost of lifting. In Bengal and Burma, the crop is entirely rain-fed. With our irrigation system we shall be able to grow money crops like cotton and sugarcane and these provinces can never hope to compete with us. Competition to capture the rice market, particularly affects districts like Tanjore most. Every year this district has got to find a market for nearly 4,200,000 *kalams* of paddy, taking the rest of its produce as being consumed in the district. To add to the trouble an increase of another 300,000 acres is contemplated under the new Mettur Project in this district. The prospects of the mirasdars are really very gloomy.

What then is the remedy? History tells us that a country like England was faced with a similar difficulty three decades ago. The farmers easily solved it by changing the methods of cropping. Most of the lands that had been utilized for growing food grains were deliberately put down to pasture and cattle rearing. So far as we are concerned here, our attempts should be directed towards reducing the cost of production of paddy in the existing areas, and trying to devote areas to crops other than paddy, wherever it is possible to do so. Although paddy will continue to be the most important crop of this district, I am sure there are areas where other

garden crops could be grown successfully and profitably. In the double crop areas of this district the combined yields of the two paddy crops are not commensurate with the trouble and labour involved. Would it not be a better proposition for owners of these double crop areas to confine themselves to a single crop of paddy and grow something else instead of the second crop? I am sure crops like groundnut, maize, chillies, etc. could be grown successfully. As an experimental measure groundnut was tried at this station last year on a very small scale and the results were very encouraging. I hope to be able to give definite results when next we assemble here a year or two later. As regards other garden crops that can be successfully grown in rotation with paddy, we might think of sugarcane, plantains, turmeric, betelvine, etc. There is certainly a great scope to increase the area under sugarcane. Several crores of rupees are every year going out of the country in the shape of the price we pay for the imported foreign sugar. Regarding plantain growing, it is nothing new to this district. Aduturai is an important centre from which big consignments of plantains go out to other parts of the province. For better nutrition and better health of the people it is recommended that they should take to eating more fruits than we are now doing. Plantain is one of the cheapest fruits we can produce and there is scope for further increase. If every member of the population would take to eating one plantain fruit per day, the area under this crop could be increased in this province alone by some thousands of acres. Unlike sugarcane there is the difficulty about the transport and marketing of plantains because of its perishable quality. In Tanjore we get plantains quite as cheap as 8 to 10 fruits or more for an anna, and the same sells at 4 to 6 pies per fruit in North India. If we can increase the production of plantains sufficiently it should not be impossible to find a market for them in North India, transporting them, if necessary, in specially built railway waggons.

With regard to the growing of these long duration crops there is the question of water facilities. If there is a channel supply for five or six months in the year, the rest of the period can be easily managed by well irrigation. Construction of small wells is not an expensive affair in this district where the water table is very high and there is no rocky substratum. The departmental work at the Samalkota and Maruteru Agricultural Research Stations has shown, that even paddy can be grown successfully with much less water than what we are used to cultivate it with. The introduction of garden crops in rotation with paddy, will indirectly reduce the amount of water that is used for the paddy crop, because of the drainage difficulties it would create. It has been demonstrated in Samalkota that plantains can be successfully grown as an annual crop in rotation with paddy, the profits brought in by an acre of this crop ranging from Rs. 500 to 800 a year. Work at the Anakapalle station with sugarcane, is indicating that it could be successfully grown with only one or two irrigations. Recently, the Government Sugarcane Expert working in Coimbatore, has succeeded in crossing sugarcane with cholam and there is the possibility of our getting in the immediate future, a cane crop that will mature within as short a period as 5 months.

Besides plantain and sugarcane there are any number of pulse and fodder crops which can be successfully grown either before or after the paddy crop. This practice actually exists in the Godavari delta. Leguminous crops like sunnhemp, *theegapasalu*, and *pillipesara* are used both

as green manures and as fodder for the cattle. Comparing the Godavari and the Cauvery deltas, by far better cattle are kept in the former tract and they are better looked after. The cattle of this district are really miserable creatures. There is plenty of scope for improving the milk supply of this district. Probably nowhere else is so much of artificial foods and tinned milks consumed as in this district. In spite of the high prices that are paid for these artificial foods, they cannot compare with natural milk from the nutritive point of view. In Italy rice fields are periodically laid down to pasture and good cows are maintained.

There is also immense scope for increasing the fruit production of the district. In the Godavari district where conditions are not very different, orange cultivation has developed enormously of late years. These are some of the points which should set the mirasdars of this district thinking, and I am sure there are enough enterprising members who would be prepared to give a right lead in this direction. It is not expected that changes are likely to come very rapidly, but the present unfavourable position of paddy growing should act as a stimulus. It need not be pointed out that the growing of garden crops in rotation with paddy will indirectly provide labour for the cultivators for a greater part of the year and will gradually increase the standard of living.

Coming now to the production of rice itself in this district where a good portion of it must find a market elsewhere, the marketing conditions are still primitive. Definite statistics regarding the movement of paddy within the province are lacking, and enquiries will have to be made soon, to gather sufficient information bearing on this point. Although the same sort of varieties are grown in Tanjore as in Kistna district, it is found that Tanjore rice never gets to the Madras market. The Andhra ryot scores over the Tanjore ryot by the availability of cheap water transport facilities. There are also certain practices like harvesting and leaving the crop in the field for a day or two, stacking them and doing the threshing some months later—practices common in Kishna, Godavari—which do not obtain in Tanjore. These practices probably help to improve the quality of rice. Harvesting the crop when dead ripe and threshing it immediately is not entirely due to the labour difficulty. It is probably more due to the landlords not having sufficient trust in the tenants. The present Tanjore practice makes the grain unfit for raw milling. All the large rice mills of this district where enormous sums of money have been sunk are remaining idle at present because of the loss in export trade of parboiled rice. Ways and means should be found to improve the quality of the produce and adapt the machinery of the large mills to husk raw rice. Tanjore being chiefly an exporter of rice should do well to study the requirements of the markets and adjust her practices.

Coming now to the new Mettur Project area, portions of it have red loamy soil eminently suitable for growing garden crops. Although by the original scheme it was designed to devote the whole area to rice growing, it will be unwise to do so under the present conditions of rice production. It should be possible to grow successfully crops like sugarcane, turmeric, plantains, and cotton. The difficulty of drainage which we are faced with in the delta will not arise. The quantity of water used for these crops would be much less than would be required for paddy with

the result that a larger area higher up from the canal can be devoted to growing garden crops with small pumping sets fitted up at different places. I see that some of the people of this new area are not for converting their lands into wetlands and devotingt them to rice growing. It is an encouraging sign but the argument put forward by them is chiefly due to the assessment of Rs. 15 per acre. Huge sums have been sunk in the scheme and Government must expect a fair revenue return and it cannot be expected that the rates will be lowered. If we compare the proposed water rates with what the ryot has to spend in making his own arrangements for obtaining it by digging a well and lifting the same by bullock power, Rs. 15 cannot be considered as excessive.

The distribution of water as at present fixed up for this new area is from September to May. If seedlings could be raised sufficiently early, transplanting can commence immediately after the receipt of water in the channels in September. It need not be pointed out that the earlier the planting, the better is the crop. Our results at the Maruteru Agricultural Research Station go to show that early planting more than compensates for the improvements sought after, by better manuring and the growing of superior strains. If seedlings cannot be raised early enough the planting is not likely to come off before the middle of October. This will roughly correspond to the present *thaladi* cropping of the delta which is not quite satisfactory. The young crop cannot make use of the heavy rains received during the north-east monsoon. Even the second crop that is to be grown between February to May cannot be a very remunerative proposition. There is thus an indirect inducement to the people to use the water in the new scheme for something other than paddy wherever it is possible to do so. I hope the mirasdars of this tract will consider the matter seriously. Probably the people have not got sufficient experience in growing garden crops like sugarcane and plantains, but the Agricultural Department should be able to give all the necessary help and guidance in the matter.

Although this station was originally designed to be essentially a paddy breeding farm we are so modifying our programme that in addition to paddy work we can demonstrate to the people of the delta that garden crops could be successfully grown in rotation with paddy. I am hoping that in the next year or two when we assemble again in this conference, you will have some tangible results demonstrated to you.

LIVESTOCK, PLOUGHS AND CARTS—CENSUS OF 1930

A REVIEW

(Kindly supplied by the Director of Agriculture)

The statements showing the distribution of cattle in the Madras Presidency under the several heads on the lines indicated in paragraphs 161 and 164 of the Report of the Royal Commission on Agriculture in India in the last three censuses will be found in Appendices A (1) and A (2).

2. There has been a marked increase of 1·7 per cent in the number of adult cattle in the quinquennium ending 1929 against the small increase of 0·013 per cent in the half decade ending 1924. The increase of 1·7 per cent is not however uniform among both males and females. The increase under males is only 0·6 per cent, but under females it is as high as 2·9 per cent, while in the quinquennium ending 1924 there was an increase of 1·3 per cent under males and a corresponding decrease under females. The variation in the last quinquennium has been small in Cuddapah, Carnatic (except females in Nellore having 13 per cent increase), North Arcot, Tinnevelly, and South Kanara (males). There has been a decrease in Vizagapatam (both males and females, 11 and 12 per cent), Kistna (males, 13 per cent), Coimbatore (males, 5 per cent), Trichinopoly (both males and females, 8 and 11 per cent) and the South (both males and females ranging from 3 to 14 per cent, the heaviest being Ramnad 12 per cent males and 14 per cent females, and Madura 10 per cent females). But there has been an increase in the Circars, Vizagapatam (males and females) and Kistna (males) excepted. The increase is largest in Ganjam, 20 per cent males. In the Deccan, the rate of increase is almost the same, 10 to 12 per cent under males and 5 to 7 per cent in females in the districts of Kurnool and Bellary; but it is conspicuously high in Anantapur, 22 per cent under males and 18 per cent under females. In the Carnatic, Nellore uniquely shows an increase of 13 per cent under females. In the Central Districts, Chittoor shows the largest increase both under males and females, 15 and 14 per cent respectively, Coimbatore 12 per cent females, and Salem 8 per cent females.

3. The number of cows worked out as having been served by a breeding bull is given in the table below :—

I. *30 to 48 cows per breeding bull.*

Tinnevelly	...	...	31
The Nilgiris	...	...	31
Coimbatore	...	...	32
Salem	...	...	38
Madras	...	...	38
Madura	...	...	44
Ramnad	...	...	48

II. *50 to 75 cows per breeding bull.*

Vizagapatam	50
Trichinopoly	55
Ganjam	58
Cuddapah	59
Bellary	68
Chittoor	75
North Arcot	75

III. *90 to 100 cows per breeding bull.*

Anantapur	90
Guntur	94
Chingleput	96
South Arcot	100

IV. *120 to 149 cows per breeding bull.*

Nellore	120
Malabar	133
Tanjore	149

V. *151 to 228 cows per breeding bull.*

East Godavari	151
West Godavari	185
Kistna	228

VI. *368 and 439 cows per breeding bull.*

Kurnool	368
South Kanara.	439

It may be noted that in some districts bulls which are kept entirely for work are not mulled and that everywhere male stock is not castrated till after they have been broken to work.

4. *Horses and ponies.*—The number of horses and ponies has fallen from 43,825 in 1924 to 39,759 in 1930 by 9 per cent. The decrease is general and the exceptions are Vizagapatam, East Godavari, Kurnool, Cuddapah, South Arcot, Chittoor, Coimbatore, and Madura. Notable decreases are shown in Ramnad (366, 47 per cent), Ganjam (679, 45 per cent), Malabar (306, 39 per cent), Tanjore (462, 36 per cent), Chingleput (384, 32 per cent), Trichinopoly (461, 32 per cent), West Godavari (602, 29 per cent), Guntur (505, 26 per cent), Anantapur (828, 25 per cent), North Arcot (307, 23 per cent) and Kistna (330, 21 per cent). In Vizagapatam, the number has risen by 19 per cent from 3,765 to 4,487 and in Coimbatore by 10 per cent from 3,205 to 3,538.

5. *Mules and Donkeys.*—The number of mules and donkeys has risen by 10 per cent from 120,217 in 1924 to 131,869 in 1930. 85 per cent of the mules and donkeys, viz. 112,231 are found in the Deccan (43,268), Madura, Ramnad and Tinnevelly (32,788), Coimbatore (16,847), and Nellore, Chittoor, and Salem ranging from 6,000 to 7,000 in each. The increase is fairly

general and is notable in the Deccan, (6,048), Coimbatore (2,025), and Chittoor (1,181).

6. *Sheep.*—The number of sheep has risen from 11,220,497 in 1924 to 12,864,343 in 1930 by 15 per cent. The increase occurs in all districts outside Vizagapatam (—17 per cent), West Godavari (—9 per cent), Cuddapah (—1 per cent), and South Kanara (unimportant). The increase is most marked in Guntur and Anantapur (24 per cent), Salem (40 per cent), and Tinnevelly (59 per cent), where the number rose by more than a million from 2,729,445 to 3,763,997. In Malabar, the number has risen from 583 to 6,360; the census of 1924 was taken during the rainy season when the animals were taken away to a drier district while in 1930 a large number of sheep not belonging to the district was in Malabar for grazing.

7. *Goats.*—The number has fallen by eight per cent from 8,048,928 to 7,406,018. The decrease is found in all districts except Ganjam (+ 41 per cent), Vizagapatam, East Godavari, Salem, Coimbatore, Malabar (+ 27 per cent), and the Nilgiris. The decrease is notable in Guntur (41 per cent), Kistna (34 per cent), the Deccan (24 per cent), and West Godavari and Tanjore (21 per cent) where the number fell from 2,436,005 in 1924 to 1,811,209 in 1930. The reasons are :—

(1) The slaughter of goats for their skins which are in keen demand in normal times, and (2) the forest policy of excluding goats from reserves on account of the necessity of providing grazing for better classes of cattle.

8. *Ploughs.*—In 1930, the number of adult male cattle was 8,756,600 and the number of ploughs 4,475,850 against 4,472,496 in 1924. This works out roughly to a plough to each pair of cattle in the Presidency. The number of ploughs has doubled in Ganjam from 190,690 to 382,368 while the number of adult male cattle has increased only by 20 per cent from 438,085 to 525,565. The proportion of ploughing cattle to ploughs in Ganjam is now 100 : 73. The high proportion of ploughs is due to the fact that the poor ryots own only ploughs and borrow ploughing cattle. In Tanjore, the number of ploughs has fallen from 424,024 to 265,500 while the number of adult male cattle has fallen only from 448,327 to 425,582. The increase in the number of ploughs in Bellary and Chittoor is greater than the increase in the number of adult male cattle as shown below :—

District.	*Percentage of increase in* Adult Male Cattle.	Ploughs.
Bellary	10	19
Chittoor	15	24

The variations in the other districts are small and do not call for any remarks.

9. *Carts.*—The number of carts has risen from 1,099,198 to 1,235,009, an increase of 12 per cent. The increase is general outside Madras, Ramnad, Tinnevelly, and the West Coast. The increase has exceeded 20 per cent in Kurnool and Anantapur (each 21 per cent), Salem (24 per cent), Ganjam (31 per cent), and Chittoor (57 per cent).

A (1) Distribution of Cattle and Buffaloes in the Madras Presidency

Census	Net Area Sown Acres (in 000's)	Total number of cattle and buffaloes in the Province (in 000's)	Percentage of cattle and buffaloes to total population	Per 100 acres of net area sown			
				Estimated grazing land	Cattle	Buffaloes	Cattle and Buffaloes
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1919	33,105	22,294	52·7	...	50	17	67
1924	33,339	22,111	52·2	79	49	18 (*a*)	67
1930	34,372	22,441	53·0	79	48	17	65

(*a*) Given in the Royal Commission Report as 17.

A (2) Statement showing Classes of Cattle in the Madras Presidency

Census	Per 100 acres of net area sown						
	Estimated grazing land Acres	Ordinary Cattle			Buffaloes		
		Bullocks No.	Cows No.	Others No.	Adult Males No.	Adult Females No.	Young Stock No.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1919	...	22	17	11	4	8	5
1924	79	22	17	10	4	8	(*a*) 6
1930	79	22	16	10	4	8	5

Column 3 relates to (1) breeding bulls, (2) other bulls, and (3) bullocks.

(*a*) Given in the Royal Commission Report as 5.

INDIA'S COMMERCIAL FIBRES[1]

PROCEEDINGS OF THE ROYAL SOCIETY OF ARTS—INDIAN SECTION

Sunn.—A useful fibre is produced from *Crotalaria juncea*, which is known under the name Sunn when exported from Bengal or Benares, but is otherwise sold as Indian hemp named after the district in which it is supposed to be produced. The plant grows to a height of five to nine feet, is topped with a yellow flower of delicate scent, and has no connection with the true hemp, *Cannabis sativa*, whose cultivation is forbidden in India to prevent the extraction of 'bhang'. *Crotalaria* is largely cultivated for green manure, and its function was recognized by Indian ryots centuries before scientists had ascertained that it occludes free nitrogen from the air. It is impossible to state what proportion of the area sown in this plant is used for fibre extraction; hence the difficulty of the Government in collecting reliable statistics bearing on the production of fibre. The value of Sunn hemp exported annually is about £650,000.

Sunn is usually sown at the beginning of the rains from April to June. The Bengal crop is sown in September or October and is ready to reap in twelve to sixteen weeks. The best Sunn ever produced was grown in the Province of Emilia in Italy. Here the seed from Bengal was sown experimentally on land deeply ploughed and cross-ploughed, well harrowed, with soil of exceptionally good tilth, as is usual for the sowing of *Cannabis sativa*. Sown in March, it was reaped in the end of July, resulting in fibre of exceptional length and strength, even in texture, of a slightly yellowish-brownish colour. The material was prepared on the same soutching plant as is used for Italian hemp. Incidentally, one of these machines was sent to Bengal some years ago, and gave good results, but it was destroyed by fire and was never replaced. The system of cultivation in small plots would, however, prevent its extended use in India.

Pusa has been helpful in regard to research work with Sunn, but it does not appear to have gone very far, and it seems likely that similar work to that undertaken in regard to jute might result in the isolation of an improved seed which would give a longer, stronger and better yielding type of fibre.

The plant is turned into fibre in the United Provinces, Central Provinces, the Bombay area, Madras, and Bengal, and is baled and shipped mostly from Bombay and Calcutta, and a little from Madras. Practically the whole of the Benares crop, running into 100,000 bales, and the Bengal Sunn, are shipped from Calcutta, also a certain part of the so-called Raighar Hemp, which is mostly treated with hackles, the dressed hemp and tow finding a ready market in Europe in competition with Russian varieties, which they closely resemble.

The variety called Dewghuddy is the best prepared, cleanest and best-known hemp from India, while the grade shipped from Philibit is the lowest type, containing a large proportion of dust and mud. Latterly, legislation

[1] Extracted from the *Journal of the Royal Society of Arts*, December 26, 1930.

against the use of this hemp has been adopted in certain European countries on account of the injury to the health of the workmen. Only the low price, at which the fibre is offered, induces buyers to use it.

In general, it may be said that grading on the Calcutta side is more accurate than in Bombay, but in recent years an improvement also has been effected in that area, probably as the result of the control of the London Hemp Association, which was founded about twenty years ago. This association issues a contract which has been drawn up largely on the lines of the London Jute Association's contract. Moreover, a panel of abritrators attached to the association is available for the settling of differences of quality. A clause in the contract which provides for invoicing back in the case of inferiority is most useful, and has had the effect of preventing the shipment of very inferior material.

Owing to the very diverse conditions in the preparation of Indian Sunn, it is scarcely feasible to consider any kind of official grading, but there is room for vast improvement in the preparation of such fibre as Benares, which could surely be prepared so as to eliminate a much larger proportion of stick and retain the original strength of the fibre. Whether the deterioration is due to the plant being over-mature when cut, or to defective seed, or to inferior methods in the cleaning, could only be ascertained by a close scrutiny of the process at each point, and by experiments conducted by the Agricultural Departments. It should be noted, however, that the excessive mud and dust already alluded to, which the Philibit variety contains, is likely to cause the cessation of its consumption, unless steps are taken to eliminate this defect.

The Imperial Institute has during the last two years been engaged in research work in regard to the resistance of Indian Sunn to water, and has brought out the interesting fact that this material is more resistant to water than Italian or Russian hemps (*Cannabis sativa*).

The Empire Marketing Board has recently issued (Februray 1930) a memorandum prepared by the Imperial Institute with the co-operation of its Advisory Committee on Vegetable Fibres, which describes the preparation of Indian hemp and gives extracts from these tests. The result has been a surprise to the trade, and can scarcely fail to improve the demand for Indian fibre as a substitute for Russian, the quality of which has steadily deteriorated since they ceased to dress it, as was customary before the war.

It is singular that, although *Crotalaria* will grow in many climates with similar rainfall and conditions to India, India should be the only country to supply this fibre, and the question arises whether the supply could be increased if the demand should call upon it.

Recently the experimental cultivation of this crop in Africa has given satisfactory results, the product proving longer, stronger, better coloured and better prepared than most of the material from India.

Howard, in his *Crop Production in India*, indicates that there is a serious barrier to any considerable increase in its cultivation in India. While water-logged soils are unsuited for its growth, on account of the poor quality of fibre produced and of the poor development of seed, its good growth in dry, well aerated soils is stultified, for want of large quantities

required for 'retting' and for the manufacture of fibre. Another obstacle is, that the crop is a complex mixture of forms, which do not breed true, and the labour involved in isolating an improved type and in the organization of seed supply, would be beyond the means of the Agricultural Department.

It is singular that Benares Sunn should be weaker and contain more stick than the Bengal variety, and it would be interesting to ascertain whether the considerable difference in quality between these two grades is due to the time of sowing. Is it a question of climatic conditions, or does the soil create so great a discrepancy in quality and price of this fibre, Bengal usually selling at approximately 30 per cent above the price of Benares? This is a subject which might be investigated by the Department of Agriculture.

Coir.—This is another essentially Indian fibre, for although the coconut tree grows right round the planet within tropical areas not too far removed from the sea, only on the Malabar Coast, Cochin and in Ceylon, is the husk treated in order to prepare from it a fibre which is used for the spinning of yarns, to be made into ropes or woven into doormats. In Africa this tree is endowed with a halo of mystery, the natives alleging that it so loves the sound of the human voice that it puts forth more abundant fruit when planted within earshot of a hut. Coir is perhaps the more resilient fibre, and is, therefore, preferred for tow ropes and other purposes in shipping where elasticity is required. The word Coir is derived from the Tamil 'kavur' (pronounced cower), which means cord, but is now applied entirely to the fibre material derived from the coconut. It is singular that throughout the world this fibre material should be wasted, but the process of retting and preparation is laborious and requires technical skill which is not found elsewhere, so that India and Ceylon enjoy practically a monopoly of this important industry.

The removal of the husks from the retting pits is as unsavoury an operation as is the same process in the case of flax and hemp. After retting the husks are washed to remove dirt and the outer rind. The work is completed by women beating the husks on a board or stone, with a wooden mallet, to separate the pith from the fibre, after which the fibre is washed in clean water and beaten with sticks, being then spread in the sun to dry. It is reckoned in Malabar that husks from 600 nuts give one hundredweight of clean fibre. The extraction of the fibre is frequently given out on contract, then returned to the merchant, who sorts it into grades according to colour and distributes the graded fibre for spinning purposes, this in some places being done by twisting it in the hands, and in other parts by spinning wheels.

Mr. Sampson concludes his book *The Coconut Palm* with the following paragraph, which is of special value, indicating the line of research which might bear fruit:—

'The fibre of the inner spathe is probably well worth investigating. It is largely used in the raw state in South India in place of rope for tying, especially for outdoor work which has to stand the weather. The fibre of the fruit stalk is an excellent straight brush fibre and it is probable that a market could readily be found for this. The leaf-stalk also contains a fairly good fibre, but whether there is any future for this is doubtful.'

In conclusion, the fibre industry of India is of paramount importance. Thanks to suitable conditions of soil and climate, an ample supply of skilled labour at satisfactory rates, and reasonable ocean freights, with an absence of long railway hauls and low-priced canal and river transport in Bengal, it may be inferred that the position is well nigh unique. Whether the best use is made of these bounties can be judged from the text of this lecture, which, without being dogmatic, attempts to show that by further agricultural and scientific research and by better co-ordination of the industry through standardization, and by more scientific marketing, it should be possible to derive a larger yield of crop of improved quality and more constant type, which should in turn secure a higher price in the world's markets for these valuable Indian products.

Notes and Comments

Sunnhemp and Other Indian Fibres.—In a former issue of our Journal (June 1930) we published an extract of a bulletin on Sunnhemp issued by the Empire Marketing Board, referring to the textile trials on Indian and other fibres and drawing attention to the fact that consequent on coming out of the trials with merit, Indian Sunnhemp has a great future, to replace Russian hemp, which is now the chief source of the world supply. Elsewhere in this issue will be seen an extract on this subject from the *Journal of the Royal Society of Arts*. The extract reports about the discussion at the Indian Section of the Society ; Mr. Alfred Wigglesworth, a noted authority on the subject, opened the discussion with an exhaustive and interesting paper on 'India's Commercial Fibres', from which we have extracted portions referring to Sunnhemp and Coir, as these two fibres alone are of particular interest to South India. Mr. H. C. Sampson, Sir Alfred Chatterton and Sir James Mackenna—names quite familiar to our readers—all took part in the discussion after the paper, and raised points which were answered by the lecturer at the end. In view of the great possibilities that lie ahead for a well organized fibre industry in India, we commend the extract to our readers.

Reports of Subordinate Officers of the Department of Agriculture, Madras.—For the first time, we believe, the printed reports of the officers of the Madras Agricultural Department have been released for sale. This is a step in the right direction.

These reports were till now confined for circulation only among Government Departments, and the decision to make them available for sale, will, we are sure, put the public more in touch with the activities of the Department. All enlightened mirasdars and the members of the Legislative Council, would find the volume extremely valuable as it would equip them with information and keep them up to date, when taking part in budget discussions of the Council. We are, however, inclined to think, that the scheduled price—Rs. 10—is a little too high and will appeal to the Government to reduce the price, so as to make it within reach of the agriculturally inclined middle classes.

Agricultural Prices.—Accord to the *Quarterly Digest* of the Operations of the Department of Agriculture, Madras, December 1930, the general fall in the agricultural prices has been the marked feature of the year. Ragi which a year ago sold at 10 seers per rupee is now selling at 15 seers. Groundnut is selling at Rs. 27 per candy against Rs. 48 last year. Paddy is selling at 14 seers per rupee, whereas previous to the depression it was selling at 11 seers. Similarly the price of Cambodia cotton last year was Rs. 242 per candy whereas in December it was selling at Rs. 157.

Such a condition which is due to favourable seasons and over-productions has to be combated in one of two ways. One is to grow crops for which there is only home demand, reducing for the time being, the area under crops like groundnut, paddy, cotton which are influenced by world markets, and raise cereals like ragi, cumbu, tenai, and cash crops like tobacco, chillies and onions and find a market for these locally. Secondly, ryots must reduce the cost of production sparing no efforts in devising methods to economize the costs in farming practices in every possible direction. Will our ryots wake up and adjust their cropping areas and modify their agricultural practices to suit the present economic crisis ?

Vitamins in Sugarcane Juice.—An experiment to find out the vitamin contents of cane juice, particularly with reference to vitamins B and D with some preliminary tests for vitamin A, was carried out by the U. S. A. Department of Agriculture, and published in the *Journal of Agricultural Research*, vol. 41, No. 10. The experiment is of great interest, in that the cane juice and its products form important articles of consumption. There is also a belief prevalent that the inhaling of the vapours from the boiling pan is considered to be very healthy. The experiments showed that there is very little of vitamins A and D but appreciable quantities of vitamin B. It has been concluded, however, that cane is a poor source of this vitamin. The upper portion of the cane is richer in the vitamin than the lower. This is probably one of the reasons why the upper portions of the cane are selected for planting. Again juice obtained from '*begasse*' by using higher pressure was found to be richer in this vitamin than the first drawn juice showing evidently the difficulty of extracting the vitamins. If this should be true it is yet another point in favour of the use of efficient crushers.

Gleanings

Crop Forecasts.—It had been stated that the forecasts of crops were now quite good. In his own days in India the first forecast had been regarded as excellent, and so had been the second forecast, by the people dealing in jute in Calcutta; but, they had said, although it was very excellent and accurate it had come in a fortnight too late. That had led him to ask a friend of his, who was a very successful dealer in jute, how it was that he had managed to do so well despite that drawback. His friend had replied, 'I only buy jute from a particular date to a particular date. I watch what the people who read the gauge of the Brahmaputra at Gauhati have to tell us, and if during a period which I have worked out during the last quarter of a century the water is below a particular level at that gauge, then I know I will only get a fourteen-anna crop because it has not had water enough. If during that period it is a certain number of inches above that figure, then I know that I will not get more than a twelve or fourteen-anna crop because a lot of it has been drowned.' So that it could be seen that some of those who had been dealing in jute, even before very much scientific attention was paid to it, had had ideas in their head which were not altogether useless—(Sir David Prain.—*Journal of the Royal Society of Arts*, December 1930).

Improved Ploughs—an Economic Problem.—The lecturer had referred to the question of ploughing. Sir James Mackenna would bear him out when he said that many members of Sir James' service had been keenly interested in the question of ploughing; it had been one of the things which naturally attracted them all when they had gone out to India first. One friend of his own, who had been a member of the Bengal Civil Service, had been so keen about the matter that he had obtained ploughs for his district from Germany, Italy, the United States and other places, and had arranged a ploughing match, at which he had actually held the plough while the man who paid a tax for the field and who owned the oxen led the oxen along. When he had finished, his friend said to the man, 'Is not this a good furrow that I have turned?' 'It is a beautiful furrow, sahib,' replied the man. 'Is not this a good plough that turned the furrow for us?' 'An excellent plough, sahib.' 'Well, won't you get a plough like this?' The man replied, 'Sahib, why should I get a plough like this?' 'Why not,' asked his friend. The man replied, 'Sahib, did you not observe that when you were holding the handles of that plough I was twisting the oxen's tails. I am a poor man, and my plough must be a plough that I can hold with one hand so that I can twist the oxen's tails with the other.' An economic problem. (Lieut.-Col. Sir David Prain, C.M.G., C.I.E., F.R.S.—winding up the discussions of the Royal Society of Arts, as chairman of the Indian Section—*Reported from the Journal of the Royal Society of Arts*, December 26, 1930).

Record Milk Yielders.—In Coimbatore, nineteen cows of the Bangalore herd gave an average yield of 14·7 pounds of milk per day, one cow averaging as high as 34 pounds per day. Her best yield on a single day was 43 pounds. The Coimbatore herd consisting of thirteen animals gave an average

yield of nearly 17 pounds per day, the best cow yielding 27 pounds on the average. Such results are not achieved in a day or in an year. They are obtained by proper selection of the best cows, careful breeding and good feeding and management of the herd. Why should not ryots obtain similar results by following these methods ? This is just the time to begin better feeding when the prices of feeding stuffs are so low.—(*Quarterly Digest of the Department of Agriculture, Madras*, December 1930).

Food Value of the Sweet Potato.—Sweet potatoes are of higher food value than white potatoes, contrary to common belief. That the protein —ipomoein—of the sweet potato is richer in the nutritionally-essential amino-acids that compose proteins, than the protein obtained from the white variety, has been shown by Dr. Breese Jones and his collaborators in the Bureau of Chemistry and Soils of the U. S. Department of Agriculture.

Proteins, those complex compounds of nitrogen, are a necessary constituent of any diet. Ordinarily we obtain our greatest amounts of these from meat, eggs or milk. Potatoes and sweet potatoes are more important as sources of starch or fuel-energy-giving material, as are also the cereal foods.

Potatoes of both kinds, however, contain proteins that are superior in nutritional quality to those of corn and white bread. They contain a greater proportion of the essential building materials for human nutrition.

The sweet potato has a further advantage. Dr. Jones has isolated and studied protein from seven or eight varieties. Not all of the nitrogen in white potato is due to protein, but to other substances of less food value. These are not found in the sweet potato.

The sweet potato is also very satisfactory in regard to its content of the essential vitamins. The common potato contains less vitamin A. Thus the sweet potato has much to recommend it as a balanced food.

The potato has been claimed by Dr. M. Hindhede, of Denmark, as the perfect food. The sweet potato is largely unknown in Europe though it was probably introduced there a hundred years before the common 'spud.' It is even mentioned in Shakespeare. It looks as if the Danish enthusiast might have to transfer his attention now to the all-American product.

Sweet potato flour can be added to wheat flour in making bread, with satisfactory results. A process has also been worked out by the Bureau of Chemistry and Soils for making syrup from sweet potatoes.

Sweet potatoes form one of the chief vegetable foods in the southern states. The Department of Agriculture suggests that a larger percentage of the crop than at present might be fed to farm animals as it constitutes a cheaper and more productive source of carbohydrate, or fuel-energy material than corn, as a supplement to such protein concentrate feeds as cotton seed, peanut and soybean meals. The sweetness is due to the action of diastase, a substance present which changes the starch into the sugar in the process of cooking.—(*Science*, New Series, Vol. lxxii, No. 1878.)

REVIEWS

Cotton Gowing in India in Relation to Climate. By Trevor Trought and M. Afzal. Memoirs of the Department of Agriculture in India, Botanical Series, Vol. xvii, No. 5. Price As. 12 or 1*s*. 3*d*.

The cotton plant being readily affected by environment, especially by the uncontrollable climatic conditions, the authors have attempted on the lines adopted by Williams in Egypt, in his survey of the conditions of the various cotton growing countries of the world, to present in a concise form, the conditions of cotton growing in India. They recognize that more meteorological data are required before the present work is considered comprehensive. Seven representative tracts which could provide them with the following data have been chosen. The normal mean monthly maximum temperature, the mean minimum temperature, the normal monthly rainfall, the number of rainy days per month, the monthly cloud amounts, the mean relative humidity at 8 a.m., and the mean velocity of wind in miles per hour are shown separately in diagrams for all the seven tracts.

To one interested to know why the time of sowing of cotton varies from May to November as we trace it from the Punjab in the north to Tinnevelly in the South, the various diagrams presented show that the cropping of cotton in the different places is so timed that it gets the maximum benefit of rainfall in the growing season, coupled with a favourable dry weather at picking times. The greatest similarity of conditions on the whole is during the middle of picking season in all the various tracts and not about a month or so before picking as found by Williams in Egypt and in the Sudan.

It is evident that the authors have meant this only as a preliminary to the studies of the relation of climate on the varieties of particular tracts.

C. V.

The Milk Problem of the City of Hyderabad. By R. R. Joshy, Esq., G.B.V.C. (Nizam's Veterinary Department). In this bulletin the author relates at some length the various factors connected with the problem of milk supply of the city of Hyderabad and attempts to suggest what he considers to be improvements in the present system.

In the first chapter of the bulletin the author deals with the geographical situation of the city and its position in relation to railways, roads, water supply and areas of forage supply. From the description given it can be seen that the city of Hyderabad is favourably situated with regard to conditions necessary for improving its milk supply on up-to-date lines.

In the same chapter the author gives an account of the existing deplorable condition of the milk supply of the city and deals with factors responsible for such a condition. In this respect the system of milk supply of Hyderabad city does not differ from that of other large cities in India. The major portion of the milk consumed is produced by animals housed and fed in the very heart of the city, the milch cattle are slaughtered after one lactation and the feed of the cattle is very expensive. All these factors together with the insanitary condition of the stables and the mode of living of the *gowla* which to quote the author 'counteracts the general efforts in the production of clean milk', have the combined effect of rendering the milk produced both unsafe and dear. Consequently the per-capita consumption of milk is very low—though this figure as

worked out by the author cannot be taken as reliable, and his comparative figures for other cities in India in this respect, represented in the graph, are by no means correct.

He concludes by saying that 'under these *extraordinarily strange circumstances* the efforts must necessarily be directed to improve the *gowlies* alone as a class' and quotes in support of this statement an extract from the Royal Commission Report, which appears to be quite irrelevant. The circumstances are in no way 'extraordinarily strange', as they exist in almost all other big cities in India to-day and wherever efforts have been made in the direction of merely improving the *gowlas* they have resulted in utter disappointment. Enlightening the town *gowla* on the value of sanitation may help in the production of cleaner milk, but it will not help in counteracting some of the baneful effects of keeping and feeding a milch animal under unnatural conditions in the town and which in the end affect the cost of milk production. If an improvement in the existing condition of the milk supply is to be brought about, it must be in the direction of both its hygienic quality and its price.

In Chapter II the author suggests a 'Remedy' for all the evils associated with the present system of milk supply. This remedy is based on the conclusion drawn by him and which altogether loses sight of the most vital economic factors involved in the production of cheap and safe milk. In this he invokes the help of the State, the Municipality and the Public.

He asks the State to give every possible facility for the provision of fodder for cattle, in the form of more grazing and cultivable areas, growing of fodder on sewage and undertaking 'cultivation for sale to the public of green fodder crops on all Government Farms under Agricultural Department', and goes on to say that 'all possible efforts must be made to improve the condition of fodder supply as the key to the whole problem lies in this. This *alone* is responsible for the whole state of affairs'. No doubt fodder for cattle forms one of the costliest items in the production of milk, for, it takes about ten tons of fodder to produce a ton of milk and as this fodder must be produced in the country remote from the city, from this point alone it is a more business-like proposition to rail not fodder but milk into the city from a place where the animals can be maintained under quite natural conditions and where they can produce a calf every year and where the conditions would permit of milk being produced under perfectly hygienic conditions. Similarly the other recommendations made about providing good bulls and holding demonstrations for educating the milk producers would have far-reaching effects if applied to people of the right type rather than to the town *gowlas* whose only idea is to get as much as possible out of their animals when in milk and then sell them straight off to the butchers as soon as they go dry.

With regard to the Municipality, the author calls upon it to build up sanitary cow sheds, milk depots and give financial help, but in none of these recommendations the author seems to be clear about his ideas. The starting of milk depots by the Municipality for the purpose of 'purchasing milk from the *gowlis* and selling the same in different localities' would entail the employment of the whole paraphernalia of a business concern without the Municipality having any control over the cost of production of the milk.

From the Public, the author expects the 'philanthropic and sympathetic generosity of the rich community', so that the problem may be solved with 'little trouble and minimum risk from the point of view of finance'. While the co-operation of the public at large is an important factor in achieving success in a problem like this, it is not so much their philanthropy as the force of opinion created by enlightening them which will help to improve matters.

In Chapter III the author gives an outline of his plan of working and for this he depends on 'two organs'—one the 'Co-operative Societies of *Gowlas*' and the other a 'Central Milk Union'. While the ultimate solution of the milk supply problem of the cities in India lies in schemes based on co-operative principles, the scheme suggested by the author appears to be as cumbersome as it would be unproductive.

He suggests the Central Milk Union to have two branches; one 'Live-stock branch' and the other 'Forage branch'. The function of the Live-stock branch would be to replace existing inferior stock in the city and its suburbs by importing dry animals from Bombay cattle stables and tending them till they come into milk again. To all familiar with conditions existing in the Bombay city stables to-day it becomes at once clear how impracticable such a scheme would be, for the animals by being kept under unnatural conditions and subjected to all forms of malpractices in the city stables are rendered unfit for further breeding in a majority of cases.

In Chapter IV the author emphasizes the importance of veterinary aid in connection with his scheme by going into details about the modes of infection of some of the cattle diseases like Anthrax, Black Quarter, etc., and the method of controlling them. While veterinary aid is a necessary adjunct in the improvement of cattle, it does not form an indispensable factor for the success of any scheme intended for the production and supply of pure and cheap milk.

The author sums up the position by saying that 'the readers must have realized now that in spite of all the difficulties the problem can easily and satisfactorily be solved by the combined efforts of all concerned'. He also states at one place in Chapter II that 'though the aim of this brief note is not the dairy in right sense, still the main object is to get pure, sufficient and clean milk,' whereas in the Introduction, he says that 'whenever this subject was dealt with, emphasis was generally laid on its technical side, but efforts in this pamphlet, except short reference to the technical aspect of the question, are mainly directed to the practical side for the actual increase in the production of milk'. It is statements like these which go to point out the failure on the part of the author to grasp the gravity of the problem he is trying to solve and also betrays ignorance of the technic which is involved in the problem of improving the milk supply of a city with a population of 400,000 people.

Taken as a whole the remedies suggested by the author would only help to perpetuate the evils associated with the existing method of milk production in the heart of the city. Such a system is unhealthy—both for the cattle and the population, costly, insufficient and altogether opposed to modern ideas regarding milk production. The solution of the problem lies in producing milk in rural areas under farm conditions where the cows would be housed, grazed and fed under most natural sourroundings and the milk not the forage railed into the city.

Z. R. K.

Correspondence

I

To

The Editor, " Madras Agricultural Journal".

Sir,

May I request you to be kind enough to kindly arrange and furnish information on the following points :—

1. The milk of cows fed on green succulent fodders is said to be rich in vitamins, whereas those fed on dry parched fodders give milk low in vitamin contents. The position of silage in this aspect may kindly be elucidated.

2. Soda powder is used along with dhall in some cases to hasten boiling. The action of the salt in the stomach in bringing about any indigestibility may kindly be furnished.

3. The constituents together with the vitamin contents of coriander powder may kindly be supplied as it is frequently used by Ayurvedic physicians.

4. In some parts it is the general practice to pit paddy grain soon after it is threshed even without any drying. The general impression is that the paddy stored underground during the summer months undergoes some curing and improves in its nutritive quality. It is also said that the grain after its removal from the pit is less susceptible to insect attack. Any scientific data that can be made use of to explain for the local opinion will be valuable. Any changes the grain undergoes in its moisture contents during its storage in the ground, if established, will explain for its said immunity to insect attack.

5. On account of the recent discoveries of vitamin distributions in various foods the green leaf vegetables are coming into prominence. It will be a useful thing if any of the readers can arrange to publish a list of green leafy vegetable plants with the following classification :—

1. Those that are being regularly cultivated ; with seasons.
2. Those that are not cultivated, but are used for curry purposes.
3. Those that lend themselves for eating in a raw condition.

Yours sincerely

BERHAMPUR. V. THIRUMALA RAO.

II

To

The Editor, "Madras Agricultural Journal".

Dear Sir,

Would you kindly let me know through the medium of your Journal, the four seasons of the year as they affect India. I am the owner of a small plot of land situated on a range of hills in the North Arcot District, at an elevation of about 3,500 ft. which I propose to devote to fruit culture, and before embarking on the project I should like to get as much information as I can. I take it that the Agricultural Department are open to give interested holders all the necessary help and guidance in such matters. The information required is, with reference to the seasons known as spring, summer, etc, in Europe, and having its counterpart in India generally, and with special reference to the region indicated. Also be good enough to let me have some information with reference to the eradication of the 'Lantana' pest. This wild shrub has practically taken possession of the land, and the task of cutting down to ground level, and then pulling up the roots is a laborious one, involving a deal of manual work and time.

Yours faithfully,

BITRAGUNTA. 'ENQUIRER'.

III

Petalody of the Androecium in Cotton

To

The Editor, "Madras Agricultural Journal".

Dear Sir,

A case of petalody in cotton, observed by me, will be of interest to the readers of the Journal. In a bulk crop of *Karunganni* cotton (*Gossypium indicum*) at the Cotton Breeding Station, Coimbatore, a plant was observed producing flowers in all of which the entire staminal column was transformed into petaloid structures (Plate I). At the summit of the column were seen a varying number of normal stamens and a few antheriferous petaloid structures exhibiting the various transitional stages (Nos. 1–7, Plate II) of the metamorphosis through which the petal-like structures had passed in their evolution from a normal stamen. The petals seem to have been formed by the dilatation of the filament and the gradual suppression of the anther sacs. The stigma, instead of being clavate with ridges and furrows as in normal flowers, was slender, cylindrical and branched at the base (Plate II.) 2. The stigmatic tips were pointed and had a few long hairs. In some specimens, a foliar membrane also emerged from the style. (Plate II.) 3.

Petalody is the transformation of the primordia of the stamens into petals and it was this phenomenon that led to the first recognition of the foliar nature of the stamen. This teratological feature may be brought about either by pathologic or physiological causes. De Bary observed that the stamens of *Knautia* were changed into violet petals as a result of the attack of the fungus *Peronospora violacea*. Molliard found that petalody of the stamens in Primula was caused by the presence of the fungus *Dematium*.

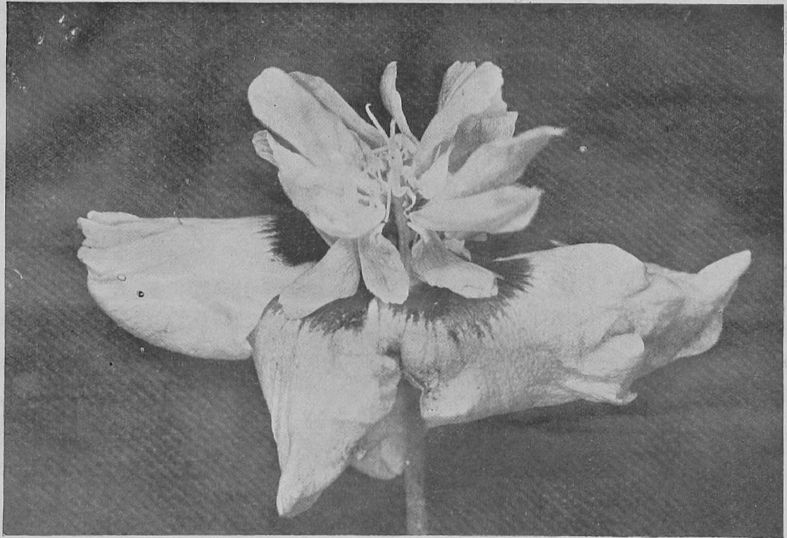


PLATE I.

A FLOWER SHOWING PETALLODY

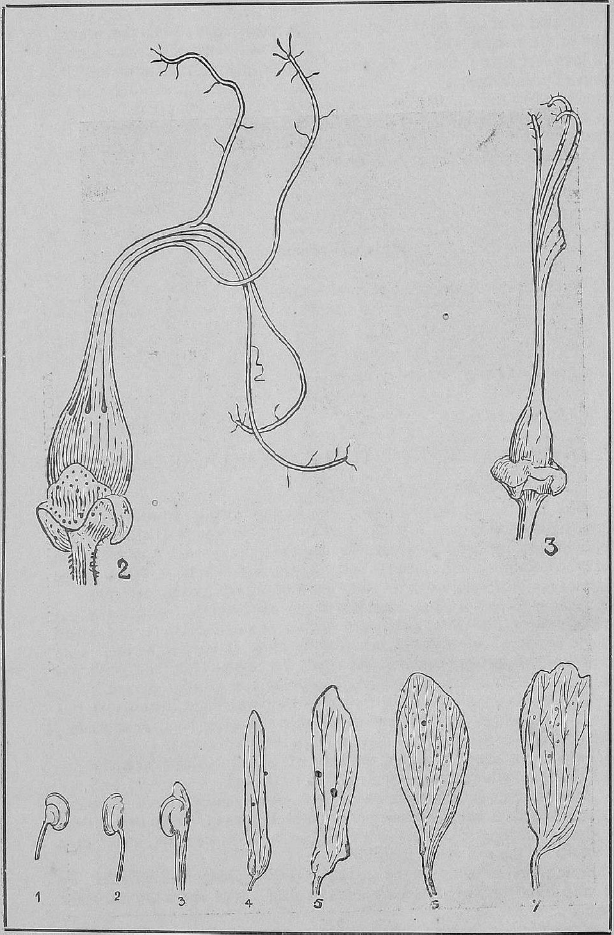


PLATE II.

Above—Pistil showing abnormal conditions of stigma.
Below—Transitional stages from a stamen to a petal.

Goebel is of opinion that petalody of stamens occurs when the primordium of the stamen is affected by the factors which cause the primordium of a foliage leaf to develop into a petal. The degree of transformation of a stamen depends upon the stage of development of the primordium at the moment when the impulse resulting in the transformation occurs, and upon the strength of the impulse. The petaloid structures may be formed by the expansion of filament as in *Clematis* or by the dilation of the anther as in *Ranunculus* or by both as in *Helleborus*.

Yours sincerely,
R. SANKARAN.

IV

Plantain Varieties

To

The Editor, "Madras Agricultural Journal".

Sir,

Will you or any of your numerous readers enlighten me through the columns of your valuable journal upon the economics of cultivation and the variety of plantain grown solely for sale of leaf ?

Yours sincerely,

RAJAHMUNDRY. T. PARAMANANDAM.

FARMING CALENDAR FOR THE COIMBATORE DISTRICT

April

With the month of April, new year begins for the Tamilian ryot of South India. In certain districts the Tamil New Year's Day marks the commencement of the cultivation season of the coming year. A simple ritual is often performed by the farmers and the first sod of earth is lifted by the owner of the land before commencing his work afresh for the new year.

The days are hot; the wind directions are from the South changing gradually to South-West. What are known as April showers also called 'mango showers' are received towards the latter half of the month. One and half to two inches of rainfall are usually recorded. With the aid of this rainfall light soils in the dryland area are broken up with the plough.

The dryland cultivation in Pollachi begins in right earnest at this period and sowings of groundnut and cholam taken on hand in this area. (Pollachi taluq receives a little more rainfall than other tracts.)

Sowings of summer cholam referred to in March Calendar are continued in this month as well during the first fortnight.

Early sowings of cholam are weeded and hoed. Regular irrigation is done.

In the eastern taluqs garden *cambu* which matures in 2½ months is raised.

Cotton picking continues both in garden and drylands and closes practically by the end of the month.

Preparation of fields for the coming *Ragi* in garden lands is taken up and seed beds for early *Ragi* are got ready and sown about the last week in some places.

Hariali in both garden and drylands is dug out.

The harvest of third crop paddy in tracts especially under the Bhavani canal is taken up and finished.

Standing crops of sugarcane, plantains, as also plantations of cocoanut and arecanut receive necessary irrigations. The crops are given good cultivation with spade.

College News and Notes

Students' Club.—Two meetings were held during February at which Mr. Gulam Mohammed, B.Sc. (Ag.) and Dr. T. R. Seshadri, Ph.D., spoke respectively on 'The Role of the Rolling Rupee in Agriculture' and on 'The Anthocyanin Flower Pigments'. There was also a lively debate at which Mr. Mahadevan of Class I moved that 'Religion and Science are complementary factors for the advancement of a nation,' and Mr. Thirumala Rao also of Class I led the opposition; the house finally deciding in favour of the resolution. The Club activities of the year came to a close with an oratorical contest, a welcome innovation of the year, for which the Secretary deserves congratulations. The subject was a 'Plea for intensive rural reconstruction,' and the judges were Dr. T. R. Seshadri, Mr. C. Narasimha Ayyangar and Dr. J. S. Patel. Mr. Y. V. Narayaniah, B.A., of Class I was adjudged the best, and Mr. Muthugopal of Class II the second.

Club Day.—This came off on February 14, and several tournaments organized for the occasion came to a successful close. A number of items in sports was also arranged in the morning and it is very encouraging to note that there was a record number of entries this year. The functions began in the evening with a tea, after which the members and guests adjourned to witness a variety entertainment. Immense amusement and *tamasha* were provided by the fancy dress competition during the tea, and the number of competitors was so large and the disguise so well and ably done, true to life, that it was impossible to spot out the winners till the end. Mr. K. C. G. Panikkar of Class III, who put on the role of Toddy-tapper carried away the first prize, while Mr. Thirumal Rao and Mr. Lakshmanachar, both of Class I, got the second prize, for their very natural impersonation of a pilgrim-couple going to Tirupati.

The public meeting at which the Secretaries read the annual reports, was presided over by Rao Sahib M. Venugopal Pillai, Public Prosecutor, Coimbatore, who gave away the prizes to the several winners, and made a felicitous speech congratulating the lucky ones and wishing 'better luck next time' to others.

Athletic Activities. *Hockey.*—The Krishnamurti Rao Memorial Hockey Tournament came to a close, the wards of Mr. K. Ramiah and Mr. V. Muthuswami Ayyar meeting in the final. The latter won after a tough and interesting struggle, which ended in a draw on the first day, and had to be replayed later.

Tennis.—The results of the Tennis Double Handicap Tournament have been announced and as anticipated Mr. Vaidyanathan and partner were the winners, while Mr. Muddanna Shetty and partner were the runners-up. The

Cecil Wood Singles Tournament attracted a large number of entries this year, and Mr. C. N. Subrahmanian and Mr. Muddanna Shetty, both of Class III, met in the final. The match was evenly contested and long drawn out, each player claiming two sets and the match had to be postponed on the final day due to failing light. On the replay, however, at a later date, Mr. C. N. Subramanian prevailed easily over his rival winning in three straight sets. Mention must be made of Mr. Dhanapandian of Class I, who met Mr. C. N. Subramanian, in the earlier round, and although beaten by the odd set in three, exhibited some fine stroke production.

Mrs. N. G. Charely kindly presided on the Tennis Day and gave away the prizes.

Association of Economic Biologists.—The annual gathering and the election of office-bearers of this Association came off on February 5; the following were elected:—Rao Bahadur T. S Venkatraman—President; Mr. S. Sundararaman—Vice-President; Mr. K. Ramiah—Secretary; and Dr. T. V. Ramakrishna Ayyar, and Mr. V. Ramanathan—Members of the Managing Committee.

On the 17th, Dr. B. A. Keen delivered a very interesting lecture under the auspices of the Association on 'Agricultural Science—its history and development.' Before the lecture the members of the Association met him at an informal tea.

Visitors.—Dr. Bernard A. Keen, D.Sc., Director of Imperial Research Institute, Pusa, was here from 17th to 19th and visited the Imperial Sugarcane Breeding Station, and the Research Institute. Mr. G. R. Hilson, B.Sc., Director of Agriculture, Madras, was here from 14th to 26th. Dr. G. J. Fowler, D.Sc., of the Activated Sludge Ltd., was here from 21st to 24th. Messrs. C. Tadulinga Mudaliar, Principal (on leave), V. Krishnamoorthy Iyer of the Indian Veterinary Service and Rao Bahadur M. R. Ramaswami Sivan were here from the 16th to the 18th in connection with a meeting of the Board of Studies in Agriculture.

Weather Review

FEBRUARY 1931

Rainfall Data

Division	Station		Actual	Departure from normal	Total from January 1.
Circars	Gopalpore	...	0	— 0·6	0
	Vizagapatam	...	0	— 0·5	0
	Cocanada	...	0	— 0·3	0
	Masulipatam	...	0	— 0·4	0
Ceded Dists.	Kurnool	...	0	— 0·1	0
	Bellary	...	0	— 0·1	0
	Anantapur	...	0	— 0·2	0
	Cuddapah	...	0	— 0·1	0
Carnatic	Nellore	...	0	— 0·1	0
	Madras	...	0	— 0·3	0·1
	Cuddalore	...	0	— 0·7	2·9
Central	Vellore	...	0	— 0·4	0
	Salem	...	0	— 0·3	0
	Coimbatore Town		0	— 0·3	0
	Coimbatore Research Inst.	...	0	— 0·5	0
	Trichinopoly	...	0	— 0·5	0·4
South	Negapatam	...	0	— 0·8	1·7
	Madura	...	0	— 0·4	0·5
	Pamban	...	0·1	— 0·5	6·9
	Palamcottah	...	0	— 1·1	1·3
West Coast	Trivandrum	...	0	— 0·6	0·5
	Cochin	...	0	— 0·9	0·5
	Calicut	...	0	— 0·2	0
	Mangalore	...	0	— 0·1	0·1
Mysore and Coorg	Bangalore	...	0	— 0·1	0
	Mercara	...	0	— 0·2	0
Hills	Kodaikanal	...	0	— 1·4	1·9
	Coonoor	...	0	— 2·7	1·7

General summary of weather conditions.

Pressure distribution was of the cold-weather type throughout the month with a ridge of high pressure invading from the north at intervals, a feature apparently associated with the traverse of Western disturbances

over the north of India. These conditions determined dry cool weather over the whole of the area. Temperature was generally below the normal during the day on the East Coast.

Rainfall was absent from the whole of the area except in the extreme south where Pamban recorded 0·1 inch, and was thus below the normal, the defect being most marked on the hills. The weather this month is in complete contrast to that of last year's when unsettled weather gave some rainfall along the East Coast. Western disturbances only affected the weather by causing a temporary rise in temperature and some increase in cloud on the Circars coast, though some rainfall occurred in the adjoining regions of Orissa and East Central Provinces.

Winds were from some point between North-East and North-West except on one or two days when Gopalpore reported coastwise winds under the influence of land disturbances.

Weather report for the Research Institute Observatory.

Absolute Maximum in shade	94°·5
Absolute Minimum in shade	61°·0
Mean Maximum in shade	90°·9
Mean Minimum in shade	65°·5
Total rainfall in month	nil.
Average rainfall in month	0·46 inches.
Departure from normal	—0·46
Mean daily wind velocity	1·3 M.P.H.
Mean 8·00 hours wind velocity	0·6 ,,
Mean humidity	79·4 per cent.
Total hours of bright sunshine	281·6
Mean hours of sunshine daily	10·0

General summary of weather conditions.

Weather was fine throughout with higher day temperatures towards the end of the month. Weather was dry and no rainfall occurred.

P.V.R.
B.S.N.

AN APPEAL FOR THE CECIL WOOD MEMORIAL

We have received the following from the Secretary, Cecil Wood Memorial Committee, for publication in the Journal :—

At a meeting of the students of Mr. R. C. Wood, M.A., Principal of the Coimbatore Agricultural College (1909–22), held on the 12th of July 1928 under the Chairmanship of Mr. K. Gopalakrishna Raju, L.Ag., it was resolved to suitably memorialize their beloved Principal, by presenting a full-sized oil painting to the college, and by making endowments for medals and scholarships.

The Committee has very great pleasure in gratefully acknowledging the contributions paid so far, and requests an early remittance of the amounts that have been promised. These are not enough, and the committee solicits warm support and liberal contributions from others—old students, colleagues, and various officers of the Madras Agricultural Department, and is glad to afford them this opportunity for showing their love and regard for Mr. Wood.

Arrangements are being made for putting up the oil paint portrait during the college day in July 1931, and it is likely to cost Rs. 400–450. The amount left over after meeting the portrait charges may be suitably diverted later on for awarding medals and scholarships to deserving students.

Won't you do your bit and send by next post your contribution?

V. T. SUBBIAH MUDALIAR,
Secretary and Treasurer,
The Cecil Wood Memorial Committee,
Lawley Road Post, Coimbatore.

February 25, 1931.

Subscriptions paid

		RS	A	P
Messrs.	K. T. Alwa ...	25	0	0
,,	K. Gopalakrishna Raju ...	10	0	0
,,	V. K. Subramania Mudaliar ...	10	0	0
,,	M. K. Nambiar.	10	0	0
,,	T. Buddavidheya Rao ...	10	0	0
,,	M. U. Vellodi ...	10	0	0
,,	M. V. Raghava Rao ...	5	0	0
,,	M. R. R. Sivan.	5	0	0
,,	V. Ramanatha Iyer ...	5	0	0
,,	M. Anandan ...	5	0	0
,,	K. T. Bhandary.	5	0	0
Messrs.	R. Sami Rao ...	4	0	0
,,	G. Jogi Raju ...	4	0	0
,,	K. Ramanuja Chari ...	3	0	0
,,	E. K. Nambiar.	2	0	0
,,	Bhagirathipadhy.	2	0	0
,,	P. M. Appasami Pillai ...	1	0	0
,,	T. S. Ramasubramanian.	1	0	0
,,	B. Siva Rao ...	1	0	0
,,	M. Satyanarayana ...	1	0	0
,,	C. V. Sarvayya.	1	0	0
,,	K. B. Viswanatham ...	1	0	0

Subscriptions promised

		RS	A	P
Messrs.	M. Anandan ...	25	0	0
,,	K. Ramiah ...	20	0	0
,,	S. Dharmalingam ...	10	0	0
,,	S. Narayaniah ...	10	0	0
,,	K. Unnikrishna Menon ...	10	0	0
,,	K. Krishnamoorthy Rao ...	6	0	0
,,	U. Vittal Rao ...	5	0	0
,,	L. Narasimhachari ...	5	0	0
,,	K. Cherian Jacob ...	5	0	0
,,	C. M. Renga Reddi ...	5	0	0
,,	K. Balaji Rao ...	5	0	0
,,	P. Kannappa Pillai ...	5	0	0
,,	S. Sitarama Patrudu ...	5	0	0
,,	E. K. Nambiar ...	4	0	0
,,	C. V. Sundaram.	3	0	0
,,	E. K. Govinda Nambiar ...	3	0	0
,,	M. Narayana Iyer ...	3	0	0
,,	S. Ramachandran ...	3	0	0
,,	V. T. S. Mudaliar ...	3	0	0
,,	K. Auvudainayagam ...	3	0	0

		RS	A	P
Messrs.	A. Chidambaram ...	3	0	0
,,	N. Sreenivasa Rao ...	3	0	0
,,	V. S. Narayanasami Iyer ...	2	0	0
,,	A. Ramasami Iyer ...	2	0	0
,,	K. M. Jacob ...	2	0	0
,,	R. Narasimhan ...	1	0	0
,,	V. Viswanathan.	1	0	0
,,	M. Chinnasamy Naidu ...	1	0	0
,,	V. Satagopan ...	1	0	0
,,	M. Athmaraman.	1	0	0
,,	M. Sanyasi Raju.	1	0	0
,,	S. Ponnusami Naidu ...	1	0	0
,,	T. A. Rengasamy ...	1	0	0
,,	T. V. Subramaniam ...	1	0	0
,,	M. C. Cherian ...	1	0	0
,,	L. K. Narayana Iyer ...	1	0	0
,,	P. S. Suryanarayana Iyer ...	1	0	0
,,	K. L. Ramakrishna Rao ...	3	0	0
,,	R. Venkataramier ...	1	0	0

V. T. SUBBIAH MUDALIAR.

February 25, 1931.

Departmental Notifications

Gazette Notification.—K. Raghavacharya, F.M., Hagari, to act as D.A.O., Coimbatore, for a period not exceeding 3 months, and to proceed on relief. K. Gopalakrishna Raju on relief by Raghavacharya, to be D.A.O., in charge III Circle. K. T. Alwa, on relief by K. Gopalakrishna Raju, to be D.A.O. in charge VII Circle. K. Unnikrishna Menon, on relief by K. T. Alwa, to revert as D.A.O., VII Circle.

D. A.'s Office Orders.—V. S. Narayanaswami Ayyar, A.D., Omalur, to be H.M., District Board A.M. School, Usilampatti. A. Chinnathambi Pillai, on relief by V. S. Narayanaswami Ayyar, to act as D.A.O., Cuddalore, for a period not exceeding 3 months. C. Narayana Ayyar on relief by A. Chinnathambi Pillai, to report himself to the Registrar of Co-operative Credit Societies, Madras.

Second Circle.—G. L. Narasimha Rao, A.A.D., Gudivada, granted l.a.p. for 15 days from 15-2-31 and leave on half average pay for 3 months and 13 days from 2-3-31.

Third Circle.—K. Hanumantha Rao, A.A.D. Rajampet, granted extension of one month's l.a.p. on medical grounds from 24-2-31.

Fourth Circle.—M. Eggiyaswami Ayyar, F.M., Palakuppam, transferred to Palur. C. S. Krishnaswami Ayyar, F.M., Palur, transferred to Palakuppam. T. V. Srinivasacharlu, A.A.D., Cuddalore, granted l.a.p. on medical certificate for 4 months from date of relief. R. Narasimha Ayyar, A.A.D., Mycology, Cuddalore, granted l.a.p. for 15 days from 3-2-31.

Seventh Circle.—On the rejoining of duty from leave of A. Gopalan Nayar, H.M., A.M. School, Taliparamba, K. M. Jacob will hand over charge to him and relieve V. K. Kunhunni Nambiar, 2nd Agricultural Teacher to join duty as F.M., No. II Nileshwar Station, as soon as possible. P. Abdulla Haji Sahib, A.A.D., Manantoddy, granted 20 days l.a.p. from 27-1-31. C. Raman Moosad, F.M., Kasargod, granted extension of l.a.p. for 12 days in continuation of one month's l.a.p. granted to him from 21-1-31. K. Soopi Haji, granted l.a.p. for 15 days from 6-2-31. In modification of a previous order, A. P. Balakrishnan Nayar, F.M., granted l.a.p. for 20 days in continuation of Christmas and New Year holidays and an extension of l.a.p. on medical certificate for 1 month from 25-1-31.

Eighth Circle.—P. S. Manian, A.D., Annur, granted l.a.p. on medical certificate for 1 month from the afternoon of 12-2-31. C. K. Subbramania Ayyar, A.A.D., in Entomology, l.a.p. for one month from 2-3-31 with permission prefix Sunday, March 1.

Curator's Section.—K. Govindan Nambiar, A.F.M., Ootacamund, granted extension of leave without allowances for 6 months from 5-2-31.

Principal's Section.—T. Gopalan Nair, F.M., Central Farm, granted l.a.p. for 20 days from 19-1-31 with permission to avail Sunday, 8-2-31. S. R. Srinivasa Ayyangar, Librarian, granted extension of l.a.p. for 6 days in continuation of the leave already granted to him. M. Raman, F.M., Central Farm, granted leave for 1 month from 9-2-31—12 days on l.a.p., and the remaining period on leave on half average pay.

P. S.'s Section.—V. M. Ramunni Kidavu, F.M., Pattambi, granted extension of l.a.p. without medical certificate for 10 days from 26-2-31 in continuation of l.a.p. for 1 month granted to him from 26-1-31.

C. S.'s. Section.—R. Govinda Rama Ayyar, F.M., Coimbatore, granted l.a.p. for 43 days from 6-2-31 with permission to avail the Penultimate Saturday and Sunday (21 and 22-3-31). M. S. Purnalingam Pillai, Sub-Assistant, Coimbatore, will be in charge of the Cotton Station during the absence of the F.M. on leave. G. Seshadri Ayyangar, Assistant, Madras Herbacium Scheme, granted l.a.p. for 16 days from 13-2-31.

G. M's. Section.—K. M. Thomas, Assistant, granted l.a.p. for 18 days from 10-2-31. P. Vishnusomayajulu, Assistant, granted l.a.p. for 30 days from 27-2-30 with permission to avail Sunday (29-3-31).

APPENDIX

ADDITIONS TO BOOKS, BULLETINS AND OTHER PUBLICATIONS RECEIVED IN THE AGRICULTURAL COLLEGE LIBRARY DURING JANUARY 1931

A. BOOKS

1.	*A Text-Book on Agriculture* ...	By Huss, B.	1921
2.	*Irrigation—Its Principles and Practice.*	,, Brown, H.	1920
3.	*Farm Machinery*	,, Stone, A. A. ...	1928
4.	*A First Course in Heat Engines* ...	,, Hayward, J. W. ...	1927
5.	*Mechanisms*	,, Andrews, E. S. ...	1926
6.	*Agricultural Surveying*	,, Malcolm, J. ...	1926
7.	*Laboratory Engineering*	,, Taylor, H. G. ...	1913
8.	*Manual of Meteorology—Vol. III.—The Physical Process of Weather.*	,, Shaw, N. S. ...	1930
9.	*Management of Farm Poultry* ...	,, Howes, H.	1930
10.	*The Statistical Methods in Economics and Political Science.*	,, Florence, P. S. ..	1929
11.	*Economic Principles for Indian Readers.*	,, Basu, P.	1927
12.	*Organized Produce Markets* ...	,, Smith, J. G. ...	1922
13.	*The Consumers' Co-operative Movement.*	,, Webb, S. & B. ...	1930
14.	*Practical Chemistry*	,, Bruce & Harper ...	1928
15.	*Organic Chemistry*	,, Perkin, W. H. and Kipping, F. S.	1930
16.	*An Introduction to the Chemistry of Plant Products.*	,, Hass, P. and Hill, T. S.	1928
17.	*Dairy Chemistry*	,, Richmond, H. D. ...	1930
18.	*The Chemistry of Cattle Feeding and Dairying.*	,, Murray, J. A. ...	1914
19.	*The Anthocyanin Pigments of Plants.*	,, Onslow, M. W. ...	1925
20.	*Mendel's Principles of Heredity* ...	,, Batson, W. ...	1930
21.	*Breeding Crop Plants*	,, Hayes and Garber ...	1927
22.	*Plant Biology*	,, Godwin, H. ...	1930
23.	*Extinct Plants and Broblems of Evolution.*	,, Scott, D. H. ...	1924
24.	*Botany of the Living Plant* ...	,, Bower, F. O. ...	1923
25.	*Dictionary of Botanical Names* ...	,, Zimmer, G. F. ...	...
26.	*Bibliographia Genetica, Vol. VI* ...	,, Lotsy, J. P. and Goddifn, W. A.	1930
27.	*Manual of Bacterial Plant Pathogens.*	,, Elliott, C.	1930
28.	*Manual of Vegetable Garden Diseases.*	,, Chupp, C.	1925
29.	*The Penicillia*	,, Thom, C.	1930
30.	*An Introduction to Zoology* ...	,, Gideon, P. W. ...	1930
31.	*' Les Insectes Nuisibles de La Province de qubec.'*	,, Beanlien, G. ...	1929
32.	*Starling's Principles of Human Physiology.*	,, Evans, C. L. ...	1930
33.	*Fleming's Veterinary Obstetrics* ...	,, Craig, J. F. ...	1930
34.	*Heredity in Live-Stock*	,, Wriedt, C.	1930
35.	*Diseases Transmitted from animals to Man.*	,, Hull, T. G. ...	1930
36.	*Sheep Diseases...*	,, Baker, E. T. ...	1929
37.	*An Economic Geography of Europe...*	,, Smith, D. H. ...	1925
38.	*Hand-Book for India, Burma and Ceylon.*	,, Murray, J. ...	1929

B. REPORTS, PROCEEDINGS, Etc.

1.	*Annual Report* of the Agricultural College, Nagpur, and of the Research officers for 1928-29.	*Central Provinces and Berar—Agricultural Department Annual Publication.*
2.	,, of the Agricultural Department, Central Provinces for 1929-30.	,, ,,
3.	,, of the Experimental Farms at Akola and at Nagpur for 1927-28	,, ,,
4.	,, of the Agricultural Chemist, Burma for 1929-30.	*Burma Agricultural Department Annual Publication.*
5.	,, of the Agricultural Engineer, Burma for 1929-30.	,, ,,
6.	,, of the Principal, Agricultural College and Research Institute, Mandalay for 1929-30.	,, ,,
7.	,, of the Economic Botanist, Mandalay for 1929-30.	,, ,,
8.	,, of the Entomologist, Mandalay, for 1929-30.	,, ,,
9.	,, of the Mycologist, Mandalay, for 1929-30.	,, ,,
10.	,, of the Akyab Agricultural Station and Kyaukpu Coconut Farm, Mandalay, for 1929-30.	,, ,,
11.	,, of the Allanmyo Agricultural Station, Mandalay, for 1929-30.	,, ,,
12.	,, of the Hmawli, Mandalay, for 1929-30.	,, ,,
13.	Kanbalu Agricultural Station Report for 1929-30.	,, ,,
14.	Mahlaing ,, ,, ...	,, ,,
15.	Mandalay ,, ,, ...	,, ,,
16.	Mudon ,, ,, ...	,, ,,
17.	Myaungmya ,, ,, ...	,, ,,
18.	Padu ,, ,, ...	,, ,,
19.	Pyinmama ,, ,, ...	,, ,,
20.	Sa-aing Farm ,, ,, ...	,, ,,
21.	Taunggyi Farm ,, ,, ...	,, ,,
22.	Tatkon ,, ,, ...	,, ,,
23.	Sericultural Operations ,, ...	,, ,,
24.	Report of the Indian Chemical Society for 1929-30.	
25.	Report of the Indian Central Cotton Committee for 1929-30.	*I.C.C. Publication.*
26.	Report of the Kenya Agricultural Department for 1929.	*Kenya Agricultural Department Annual Publication.*
27.	Abridged Report of the Royal Commission on Agriculture—Canarese Translation.	,, ,,

C. BULLETINS, PUBLICATIONS, ETC.

28.	List of Papers on Plant Genetics—Vol. I, No. 2 ...	*I.A.B. Publication.*
29.	Agricultural Research in 1929	*England Royal Agricultural Society Publication Imperial College of Science and Technology—Huxley Memorial—Lecture—1929.*
30.	The Origin of a Land Flora	,, ,,
31.	The Binomics and Control of Rice Bug ...	*S.S. and F.M.S. Agricultural Department Science Series, No. 4.*
32.	Sericulture in 'Iraq'	*Iraq Agricultural Department Memoir No. 14.*
33.	Some modern methods of Field Experiment and their Statistical Analysis.	,, *Bulletin No. 22.*

34.	The Blackhead Persian Sheep	*Union of South Africa Agricultural Department Bulletin No.* 82
35.	The Home Vegetable Garden in the Karroo ...	,, ,, 84
36.	Farm Dairying—The handling of milk and cream.	,, ,, 85
37.	The Kenya Coal Tar Ant Repellent, Kresotow ...	*Kenya Agricultural Department Bulletin No.* 7
38.	The Diseases of Plants Prevention Rules and for 'Coffee'.	*Kenya Agricultural Department Special Publication.*
39.	Mechanical analysis of finely divided natural phosphates.	*U.S.A. Agricultural Department Technical Bullettin No.* 212
40.	The Physical and Chemical Characteristics of Certain American Peat Profiles.	,, ,, 214
41.	A Biological Study of Trichogramma Minutum Riley as an egg parasite of the Oriental Fruit Moth.	,, ,, 215
42.	The Catalase content of the Colorado Potato Beetle during metamorphosis.	*Reprint from the Journal of Agricultural Research Volume XLI, No.* 7.
43.	Tomatoes for canning and manufacturing ...	*U.S.A. Farm Bulletin No.* 1233
44.	Currants and Gooseberries—Their culture and relation to White Pine Blister rust.	,, ,, 1398
45.	Citrus Fruit Growing in the South West ...	,, ,, 1447
46.	The Common Barberry and Black stem rust ...	,, ,, 1544
47.	Potato Production in the Far Western States ...	,, ,, 1639
48.	Fire Safeguards for the Farm	,, ,, 1643
49.	Asparagus Culture	,, ,, 1646
50.	Flaxseed Production by Power Farming methods in the Northern Great Plains.	,, ,, 1650
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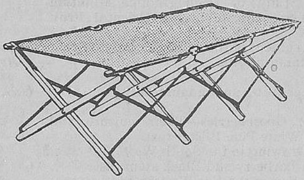

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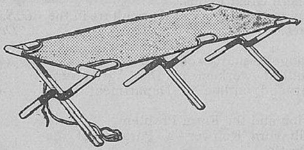

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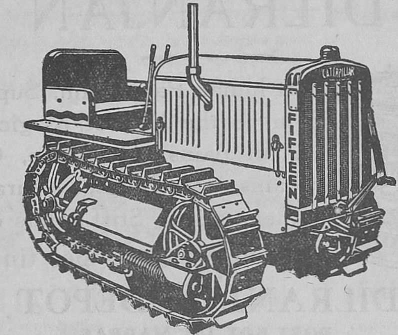

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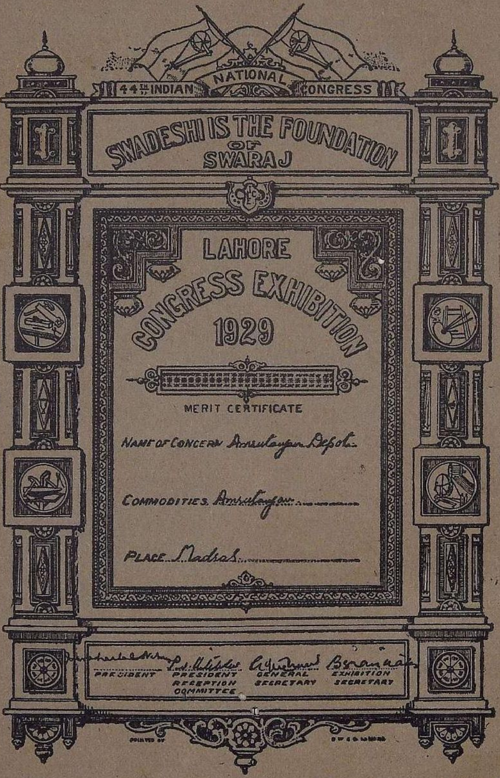

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